MONTHLY WEATHER REVIEW,

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(General Weather Service of the United States.)

WAR DEPARTMENT,

Office of the Chief Signal Officer,

DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

INTRODUCTION.

In compiling the present REVIEW the following data, received up to March 14th, have been made use of, viz: the regular tri-daily weather charts, containing the data of simultaneous observations taken at 119 Signal Service stations and 11 Canadian stations, as telegraphed to this office; monthly journals and means, 126 and 145 respectively, from the former, and monthly means from 13 of the latter; reports from 26 special Sunset stations; 232 monthly registers from Voluntary Observers; 48 monthly registers from United States Army Post Surgeons; Marine Records; International Simultaneous Observations; monthly reports from Voluntary Observers in, and the local Weather Services of the States of Iowa and Missouri; reliable newspaper extracts; special reports.

BAROMETRIC PRESSURE.

Upon chart No. II is exhibited by the isobaric lines the general distribution of the atmospheric pressure, as reduced to sea-level, for the month. Compared with the means for February of previous years, those of the present month are decidedly above the normal on the Pacific coast from San Francisco northward, in the Northwest and over the Gulf States, but are about normal in the Atlantic States and Lake region.

The Local Barometric Ranges for the month, as reduced to sea-level, have been largest over New England and New York, and smallest along the Gulf coast and from the Rocky mountains westward. Taken by districts they vary as follows: New England, from 1.85 at Eastport to 1.55 at New Haven and 1.33 on summit of Mt. Washington; Middle Atlantic States, 1.63 at Albany to 1.11 at Norfolk; South Atlantic States, 1.00 at Charlotte to 0.61 at Jacksonville; Lake region, 1.52 at Rochester to 1.04 at Milwaukee; Ohio valley and Tennessee, 1.23 at Pittsburg to 0.88 at Chattanooga and 0.96 at Nashville; Gulf States, 0.35 at Key West to 0.71 at Montgomery, 0.74 at Indianola and 0.93 at Corsicana; the Northwest and Eastern slope of the Rocky mountains, 1.42 at Pembina to 0.98 at La Crosse, 1.26 at North Platte and 1.05 at Fort Sill; Rocky mountains, 0.50 at Cheyenne to 0.72 at Santa Fe and 0.74 at Pike's Peak; Western plateau, 0.55 at Winnemucca to 0.80 at Boise City; California 0.43 at Red Bluff to 0.62 at San Francisco.

Areas of High Barometer.—Nine are described below. Six of these first appeared north of Dakota or Minnesota, and moved south or east towards the Gulf or Atlantic coasts. Nos. II, VI and IX appeared over the Pacific States, over which region the pressure was above the normal on twenty-four days.

No. I—is a continuation of area No. XI, noticed in the *January Review.* It was central over the Northwest on January 30th and 31st, during which days a severe northerly snow-storm prevailed in central Nebraska. In consequence of this snow, remaining on the ground throughout the entire month of February, and the prevailing low temperatures, thousands of cattle are reported to have died on the plains. From *February* 1st to 3rd the highest pressure moved south-southeast to the Gulf of Mexico, and cool northwesterly winds, gradually backing to warmer west or southwest, prevailed west of the Mississippi. The minimum temperatures of the month prevailed in the South Atlantic States and Florida from the 2nd to the 4th. In Texas northeasterly winds, with cloudy and rainy weather, backed to warmer southerly on the 3rd, in advance of low pressure area No. II.

No. II—continued over Washington Territory and Oregon from the 1st to the 5th. During these days cool, clear weather and northerly winds generally prevailed throughout the Pacific States, excepting the rain in southern California on the 3rd and 4th, attending low area No. II. On the 4th the winds increased to brisk and high in the Sacramento valley, and on the 5th the pressure commenced falling north of Oregon, with southerly winds and by night light rains, in advance of low area No. IV. From the 5th to the 7th

the lowest temperatures of the month occurred from the Pacific coast to western Texas, and it is probable that this area of high pressure was transferred to the Southwest, in rear of low area No. II. The following minimum temperatures of the month were recorded: On the 5th, San Francisco, 43°; Los Angeles, 38°; Sacramento, 33°; Boise City, 9°; Pioche, 5°; Cheyenne, −6°, and Pike's Peak, −21°; on the 6th, at San Diego, 38°; Santa Fé, −3°, and Dodge City, 6°; and on the 7th, Fort Craig, N. M., 14°; Graham, Texas, 17°, and Galveston, 36°. During the 7th this area moved northeast to the Ohio valley, and on the 8th east off the Middle Atlantic coast.

No. III.—On the 7th and 8th the pressure rose over Manitoba, and on the latter day cold northerly winds spread southward to Kansas and Missouri. 9th, the highest pressure moved rapidly southeast, and by night extended from the Lower Lakes to the Middle and South Atlantic coast. 10th, it moved off the Atlantic coast, followed by easterly winds and increasing cloudiness in advance of low area No. IV.

No. IV—followed in rear of low area No. V. 11th, was over Manitoba. 12th, centre moved south to Dakota and Minnesota, and northerly winds extended to the interior of Texas and Tennessee. 13th, was central in the Missouri valley, and a brisk norther commenced on the Texas coast. Cautionary Offshore Signals ordered on the 12th at Indianola and Galveston were justified on the 13th and 14th by N. 36 and 32 respectively. 14th, moved into the Mississippi valley, and on the 15th passed east over the Atlantic States. The following minimum temperatures of the month attended this area: On the 12th, at Deadwood, Dak., −12°; 14th, North Platte, −13°; Corsicana, 23°; 15th, Cleveland, −2°; Knoxville, 11°; Vicksburg, 24°; Montgomery, 28°; New York, 8°, and Lynchburg, 17°.

No. V—was north of Manitoba on the 15th, and on the 16th spread eastward north of the Lake region. 17th, moved east to the St. Lawrence valley, with very low temperatures in Ontario, the a. m. minimum at Rockliffe being −30°. High pressures and low temperatures continued over the Canadian Maritime Provinces until the morning of the 20th, during which day the barometer fell rapidly in advance of low area No. VI; the barometer at Halifax, N. S., fell from 30.32, at 7.35 a. m. (Washington time) of the 20th, to 28.90 at 7.35 a. m. of the 21st.

No. VI.—Higher pressures prevailed on the Pacific coast from the disappearance of the secondary depression attending low area No. IV to the 18th, with partly cloudy or cloudy weather and light rains from San Francisco northward. On the 19th and 20th the maps of departures from the normal show a decided excess, averaging about 0.30 of an inch, over Utah and New Mexico, and a rapid fall occurred during latter day in Washington Territory.

No. VII—appeared over Manitoba on the 19th, and at 11 p. m. the pressure reached the maximum of the month (30.84 or 0.62 above normal) at Pembina, minimum a. m. temperature on the morning of the 20th, −37° 20th moved south and east, and at 11 p. m. extended from the Lakes to the Gulf. 21st, the pressure fell over the Lake region and at 11 p. m. the highest pressure was over the South Atlantic States and Florida.

No. VIII—appeared north of Montana on the 25th: was central over the Northwest on the 26th; over the Ohio valley and Lake region on the 27th, and over the St. Lawrence valley and Maine on the 28th. During the passage of the area the maximum pressures of the month occurred from the Lower Lakes eastward; and the following minimum temperatures of the month were recorded:— on the 26th at Pembina, −44°; Bismarck, −26°; Fort Gibson, 14°. 27th, Embarrass, Wis., −40°, mercury froze at daylight; Duluth, −26°; Port Huron, −5°. 28th, Burlington, −7°; Wood's Holl, 11°; on Mt Washington the minimum was −21°. At this station the minimum for the month (−23°) occurred on the 25th.

No. IX.—From the 21st to the 28th high pressures generally prevailed along the Pacific coast, except on the 23rd and 27th, on which days temporary depressions accompanied by heavy rains, existed over Washington Territory.. Clear weather generally prevailed over California, and partly cloudy weather with occasional light rains, excepting the above, over Oregon and Washington Territory.

Areas of Low Barometer.—Nine well-defined areas of low pressure have appeared upon the tri-daily charts for the present month, and the tracks of the centres of seven of these depressions will be found on chart No. I. Of the two tracks not on the above chart, that of area No. I will be found on the International Chart of storm tracks. That of No. VII was considered too far north to appear on chart No. I. Areas Nos. IV and VII probably originated west of the Rocky Mountains; areas Nos. II, III, VI, VIII and IX over the eastern slope of the Rocky Mountains north of Wyoming, and area No. V over Utah or Colorado. This offers a strong contrast to February, 1878, during which month seven of the eleven areas of low pressure which appeared within the limits of the United States were traced from the Pacific Ocean, and six of these entered the States south of the 47th parallel. The daily charts made from the International (7:35 a. m., Washington time) simultaneous reports, received at this office, show the areas of low pressure over the North Pacific Ocean during that month to have moved slowly eastward, and to have extended much further south along the American coast than, in all probability, they usually do. During the present month high pressures have predominated over the Pacific States, and the area of low barometer has probably existed further north.

No. I.—From the 1st to the 3rd of the present month the pressure continued very low over the Canadian Maritime Provinces, due probably to the existing low pressures over the northern portion of the north Atlantic ocean and to the passage northeastward of low-pressure area No. XV, of the *January Review*. On the early morning of the 1st high northerly winds prevailed on the North Carolina coast, and brig "Maid of Llangollen" reported severe gale during the day within sight of the Bermudas. At Prospect, Bermuda, the pressure fell from about normal on the morning of January 31st to 29.65 at 9 a. m., February

1st; wind SW. 2d, barometer at Prospect, Bermuda, 9 a. m., 29.68. Very low pressures, brisk northwesterly winds and snow prevailed from Maine to Cape Breton. 3d, low but slowly rising pressure continued over Nova Scotia, Cape Breton and New Brunswick, with westerly winds and clearing weather. Cautionary Signals were ordered up at midnight of January 31st along the North Carolina and New Jersey coasts, and were justified by the following velocities: Kittyhawk and Cape Henry, NW. 42; Cape May, NW. 52 and Sandy Hook, NW. 46. On the afternoon of February 1st the above Signals were changed to Off-shore, and Cautionary Off-shore Signals were ordered up from New York to Eastport; these latter were justified by brisk to high northwest winds. The first portion of the track of this area will be found on chart No. I, accompanying the *January Review*, after which it probably crossed the ocean, as shown on the International chart of storm tracks.

No. II.—After the passage southward of high area No. I on the 1st the temperature rose rapidly over Wyoming and Montana, and partly cloudy weather, with light winds and calms, prevailed over this region until the morning of the 3d. 3d, southerly winds and rising temperature, with increasing cloudiness, prevailed from the Lower Missouri valley to Texas, and with rain during latter part of day from the Rio Grande valley to southern California; but from Wyoming and Montana to Minnesota the winds changed to colder northerly and a somewhat heavy snow-storm set in, which extended during the 4th southward to Utah, northern New Mexico and Kansas. These conditions gradually developed an extensive area of low pressure, the centre of which moved southward on the 3d, and on the morning of the 4th, a well developed barometric depression was central from Arizona to northwestern Texas, the barometers at Santa Fe and Fort Sill reading 29.37 and 29,63, respectively; or, about 0.35 inch. below the normal. Heavy rains fell during the early morning of the 4th in Arizona, and at 7:35 a. m. the area of precipitation extended from southern California to Wyoming, and thence to Texas and Mississippi. During the day increasing cloudiness followed by rain or snow, prevailed from the Gulf to the Lakes, and the centre of depression moved east to Arkansas. Cautionary Off-shore Signals were ordered at Indianola and Galveston at midnight of the 4th, and were justified on the morning of the 5th. Maximum velocities; Indianola, N. 37, and Galveston, N. 26. 5th, centre moved east the Ohio valley and Middle Atlantic States; the area of precipitation extended from the Gulf States to the Lakes and Atlantic coast, being heaviest in Tennessee and Kentucky and falling as snow north of a line drawn from Columbus, O., to Connecticut. Cautionary Signals ordered up along the coast from Smithville to New York on the morning of the 5th and changed to Off-shore on the afternoon were justified except at Cape Henry and Norfolk. Maximum velocities: Cape Lookout, SW. 40; Cape May, SE. and NW. 32, and Sandy Hook, N. 27. As this area passed east off the Atlantic coast the region of brisk to high winds was confined to a narrow belt lying between the parallels of 34 and 40; during the latter half of the 5th and morning of the 6th the pressure fell at the Bermudas, with rising temperature and southwest winds, and on the 6th steamer "Westbourne," lat. 39° N., 60° W., experienced a gale from SW. (hurricane) to NW., while to the northward easterly winds and squally weather were reported. The track of this area is prolonged on the International chart, as there is probably some connection between it and the area of very low pressure, which existed over the ocean east of the 40th meridian on the 9th.

No. III—probably developed over Wyoming and Montana during the 6th and 7th, and moved almost directly east along the 45th parallel to Nova Scotia by midnight of the 9th. At 11 p. m. of the 6th, the lowest pressure of the week, (29.40 or 0.23 below normal,) occurred at Virginia City, Mont. 7th, southeast winds and light snow in Dakota. 8th, centre moved to Lake Huron; light snows fell from Minnesota to Ontario. Cautionary Signals were ordered at Milwaukee, Grand Haven and Ludington on the afternoon of the 8th and were justified; maximum velocities:—Milwaukee, NW. 31, and Grand Haven, SW. 28. 9th, moved east to Nova Scotia; brisk and occasionally high westerly winds and light snows, followed by clear weather from the Lower Lakes to New England. Cautionary Signals were ordered at Easport on the morning of the 9th and were justified by a NW. gale which reached its maximum (43) at 10 a. m. of the 10th. Cautionary Off-shore signals were also ordered on the morning of the 9th along the New Jersey coast and were justified; maximum velocities:—Cape May, NW. 32, and Sandy Hook, NW. 36.

No. IV.—During the 7th and until afternoon of the 8th the pressure fell rapidly on the Pacific coast. 8th, brisk and occasionally high southerly winds, and heavy rains prevailed north of San Francisco; at 4:30 p. m. the lowest pressure (29.36, or 0.33 below normal) was recorded at Olympia. Heavy NE. winds, with three inches of snow, were reported at New Westminister, B. C., and at Victoria, V. I., a severe SW. gale prevailed. At night clearing and clear weather was reported at Portland and Olympia, and the lowest pressure probably moved eastward. Low pressures however continued over this region until the 12th, on the morning of which day a second minimum occurred at Olympia. Cloudy and rainy weather continued during these days from northern California to Utah and Idaho, with southerly winds, high temperatures and gradually increasing pressure. On the 11th, colder northerly winds, snow and rain prevailed in Washington Territory, and the observers at Westminister, B. C., and Victoria, V. I., report very heavy northerly snow-storms. 9th, lowest pressure was over Montana and Dakota. 10th, moved down the Missouri valley, preceded by southerly winds and rain in the Mississippi valley and eastern Texas, and followed by northerly winds, with snow from Montana and Wyoming to Lake Superior, and with clear, cooler weather from Nebraska to western Texas. In the latter State, a tornado occurred about 5 p. m., of which notice is made under the head of Local Storms. 11th, it moved to the Lower Lakes, and south to west winds and rain prevailed thence to the Gulf and Atlantic coasts; northerly winds and heavy snow, from the Upper Lake region to the St. Lawrence valley. 12th, moved down the St. Lawrence valley, with increasing energy. Heavy rains or snow prevailed, in advance of the centre, along the New England and Canadian coasts, and

St. Lawrence valley during first half of day. Heavy freshets resulted from Pennsylvania to New England, and in Canada railroad traffic was seriously impeded by snowdrifts. 13th, it probably passed northeastward over Labrador. Cautionary Signals, ordered on the afternoon of the 9th at Milwaukee, Grand Haven and Ludington; at 4:35 p. m. and midnight of the 10th from Smithville, N. C., to New York, and on the morning of the 11th, from New Haven to Eastport, were all justified; those along the Atlantic coast were changed to Cautionary Off-shore at midnight of the 11th or morning of the 12th. Maximum velocities, Milwaukee, N., 30; Grand Haven, N., 36; Smithville, SW., 31; Cape Lookout, SE., 38; Cape May, W., 36; Sandy Hook, NW., 46; New London, NW., 36; Boston, SW., 55 and Eastport S. 36.

No. V.—During the latter part of the 14th, on the 15th, and morning of the 16th, the lowest pressures were over Utah, Colorado and New Mexico, while on the Pacific coast and over the eastern section of the country the barometer was decidedly above normal, (see areas of high pressure Nos. V and VII.) Over this region the present area slowly developed, with cloudy weather and light snow. On the 16th, the centre moved southeast over Texas, and the area of rain or snow spread rapidly eastward to the southern portion of the Lake region, and South Atlantic coast. 17th, the centre moved off the coast of North Carolina and the area of precipitation spread over the Middle States and New England. Heavy rains fell in Tennessee and North Carolina, but from Kentucky and Virginia northward, except along the immediate coast south of Barnegat, the precipitation occurred as snow. 18th, northerly winds, rain or snow continued throughout the Atlantic States and Lower Lake region in advance of area of high pressure No. VI. Cautionary Signals ordered along the Atlantic coast from Smithville to New York on the the afternoon of the 16th, from New Haven to Boston on the morning and at Portland and Eastport on the afternoon of the 17th; were all justified. Maximum velocities:—Cape Lookont, S. 32; Cape May, NE. 28; Sandy Hook, E. 37; Boston, N. 37, and Eastport, NE. 33.

No. VI—approached Manitoba from the northward on the 17th, and on the 18th moved east-southeast to southern Minnesota, accompanied by light snow. 19th, continued east-southeast to the Lower Lakes, and rain or snow extended south to Tennessee and east to New Jersey and New England. 20th, moved east over the Middle States and southern New England, with increasing energy. High northerly winds and gales prevailed along the coast from North Carolina to Maine, accompanied by a heavy snow-storm over New England and by clear and colder weather southwards. 21st, the pressure fell rapidly over Nova Scotia and Cape Breton, producing a very steep barometric gradient over the Canadian Maritime Provinces and Maine. At 4:35 p. m. the pressure at Halifax, N. S., had fallen to 28.75, or about 1.15 inches below normal, and at 11 p. m., at Sydney, C. B., to 28.50, or about 1.39 below the normal. Northeasterly backing to northwesterly gales and heavy snows prevailed over the Canadian Maritime Provinces and eastern Maine, and northwest gales, with clear, colder weather over the rest of New England. Cautionary Signals ordered on the morning of the 19th at Milwaukee, Grand Haven and Ludington, and at midnight of same day from Smithville, N. C., to Eastport were all justified. Those along the Atlantic coast, from Smithville to Sandy Hook, were changed to Cautionary Off-shore on the morning of the 20th, and from New York to Wood's Holl on the afternoon of same day. Maximum velocities: Milwaukee, NW. 28; Wilmington, NW. 37; Cape Lookout, NW. 44; Cape Henry, NW. 54; Cape May, NW. 56; Sandy Hook, NW. 48; Wood's Holl, E. 40 and NW. 48; Boston, NW. 40; and Eastport, NW. 52.

No. VII.—Falling barometer, southerly winds and rain, followed by rising barometer and northwest winds, prevailed in Oregon and Washington Territory during the 20th, and by midnight an area of low pressure was central north of Montana. 21st, it passed over Manitoba to north of Lake Superior, and thence during the 22d to north of the St. Lawrence. During the latter day high temperatures, cloudy weather and rain prevailed from the interior of the Gulf and South Atlantic States to Lake Erie, and thunder-storms occurred in the Lower Mississippi valley. 23d, it moved northeast to the north of the St. Lawrence. Clearing weather, with occasional light snows, prevailed from the Lake region to New England; and high temperatures, with rain and thunder-storms, followed at night by cooler, clearing weather, in the East Gulf and South Atlantic States. Cautionary Signals ordered on the morning of the 21st at Milwaukee, Grand Haven and Ludington, and along the Atlantic coast from Smithville, N. C., to Sandy Hook, were justified. Maximum velocities: Milwaukee, W. 36; Grand Haven, W. 50; Cape Lookout, SW. 27; Kittyhawk, SW. 30; Cape May, S. 33, and Sandy Hook, NW. 32. As the centre of depression continued to the north of our stations its track is not charted.

No. VIII—appeared in the Upper Missouri valley on the 23rd and moved southeast to Missouri on the 24th. Clear or fair weather and high temperatures prevailed to the south and west of the centre, and the maximum temperatures of the month occurred at stations along the eastern slope of the Rocky mountains. Over the Lake region and the Northwest east to north winds prevailed, with low but rising temperatures, snow and sleet, gradually changing to rain in northern Illinois as the centre of depression approached. 25th, centre moved slowly east to Ohio. Southerly winds and high temperatures prevailed from the Ohio valley and Virginia southwards; light rains fell in Tennessee, Kentucky and the Virginias. North of the centre of depression snow or sleet prevailed, changing to rain along the southern shores of the Lower Lakes, with easterly winds from New England to Lake Ontario and northerly winds from Lake Erie westward. 26th, centre of depression moved northeast to the valley of the St. Lawrence; brisk to high southerly winds, with high temperatures and light rains, prevailed throughout the Atlantic States during the day, but changed to colder northwest during the night in advance of high area No. X. 27th, centre moved rapidly eastward over the Gulf of St. Lawrence, followed by brisk northwest winds and heavy rain, sleet or snow in Maine and New Brunswick. During the passage of this depression the following highest temperatures of the month

occurred at stations to the south of the centre: on the 24th, at Dodge City, 74°, Fort Gibson, 77°, and Denison, Tex., 78°; 25th, Shreveport, 80°, Montgomery, 73°, Chattanooga, 69°, Louisville, 65°, and Cleveland, 47°; 26th, Savannah, 74°, Wilmington, 73°, Fort Whipple and Philadelphia, 60°, Rochester, 46°, and Boston, 56°. The sudden fall of temperature in advance of high area No. X produced the largest daily ranges of the month at the majority of stations over the region traversed. Cautionary Signals ordered up at Milwaukee, Grand Haven and Ludington, and along the Atlantic coast from Smithville to New York, on the afternoon of the 24th; from New Haven to Boston on the morning and at Portland and Eastport at midnight of the 25th, were all justified. Maximum velocities—Milwaukee, NW., 34; Cape Lookout, NE., 44; Kittyhawk, NE., 50; Cape May, S., 40, and NW., 46; Sandy Hook, SE., 28; Wood's Holl, S., 48, and Portland, N., 36.

No. IX—was central over southwestern Montana and Wyoming on the 27th, with cloudy weather and high temperatures near or south of the centre, and cold easterly winds and snow in the Missouri and Mississippi valleys in rear of high area No. X. 28th, centre moved southeast to Iowa and thence to Wisconsin; cloudy or partly cloudy weather, with light rain or snow, prevailed thence to the Lake region; northerly winds, with snows, followed by clear weather, gradually spread southward to Kansas and Missouri. Cautionary Signals ordered up at Milwaukee, Grand Haven and Ludington on the morning, and along the Atlantic coast from Smithville, N. C., to New York on the afternoon of the 28th, were only justified at the Lake stations and on the North Carolina coast. Maximum velocities: Milwaukee, S. 30 and Cape Lookout, NE. 46.

INTERNATIONAL METEOROLOGY.

On chart No. IV are shown the probable tracks of storm-centres over the oceans, deduced from data received at this office up to February 8th; and in the upper right hand corner will be found an index to the same. In the upper left hand corner is a small table giving the approximate wind direction and probable maximum velocities (in miles per hour) attending the depressions on the dates given. Below is a brief notice of these, and also of some over the Southern Hemisphere.

Atlantic Ocean.—No.I,is a continuation of area No.VIII of the *January Review*; it probably moved rapidly eastnortheast and developed into a severe storm on January 18th and 19th over the Middle Atlantic,after which it passed southeast over Spain. No. II, is a continuation of No.VII of *January Review*, and probably followed the track shown on chart in advance and to the north of the preceding area. No. III, is a continuation of area No. X of the *January Review*,and probably passed northward over Newfoundland. No. IV, is a continuation of area No. XII of the *January Review*, which moved east-northeast and on the 25th developed into quite a severe storm about lat. 54° N., long. 30° W. No. V, is a continuation of area No. XIII of the *January Review*; it passed northward on the 27th, being opposed by high pressures over the East Atlantic. No. VI.—Low pressures were indicated in the positions marked upon the chart on January 29th and 30th, and on *February* 2nd a "violent revolving storm," with tremendous sea, was reported in 43° N., 24′ W.; this was probably near the centre of the low area which, on the 4th, passed southeastward over France. No. VII is a continuation of area No. I of the present REVIEW, which moved northeastward with increasing energy, and developed into a somewhat severe storm north of the 50th parallel. No. VIII is a continuation of No. II of the present REVIEW; it passed between the Bermudas and Nova Scotia on the 6th; on the 7th and 8th was attended over mid-ocean by rainy and squally weather, and on the 9th and 10th developed into a severe storm east of the 50th meridian; on the 11th it probably divided into two centres as shown. *South Atlantic Ocean.*—At Montevideo, *December* 31st, 1878, a heavy SW. gale, or "pampero," commenced, lasting until the morning of January 2nd, 1879; the barometer fell to its lowest level, 29.48, at 11 p. m., December 31st; the storm was preceded by NW. and N. winds, and accompanied by thunder, lightning and rain; the maximum velocity of wind was 65 miles per hour. On *December* 30th, in latitude 30° S., 28° W., a sharp shock of an earthquake was felt by the British ship "Coolen." *North Pacific Ocean.—November* 27th to 30th, from 38° N., 168° W. to 34° N., 176° W., fresh to strong westerly gales, with heavy seas, hail and sleet, lowest barometer, 29.50. *January* 15th, at 10 p. m., a thunder-storm passed over Yokohama attended with rain and hard squalls, during which the pressure fell to 29.61, wind SW., moderate gale. *South Pacific Ocean.—November* 13th, Bark Ophelia (from San Francisco to Queenstown) passed Pitcairn Island November 10th, and on the 13th entered a "heavy cyclone." *Victoria, Australia*, on *September* 24th and 25th, 1878, an area of low pressure passed over this colony, during which the barometer at Melbourne fell to 29.192 (or 0.827 below the average for September); it was accompanied by gales and squally weather, with thunder, lightning and hail showers. *Indian Ocean*, on *December* 15th, 1878, a cyclone, probably traveling southward, was encountered by the following vessels: Ship John O'Gaunt, lat. 20° S., long. 74° E., "hurricane"; Ship Charlotte Croom, 18° 49′ S., 68° 23′ E., "cyclone, barometer fell to 28.80"; Bark Dulcimer, 21° S., 73° E., "cyclone, beginning at ENE., veering to N. and ending at NNW., bad weather lasting 24 hours; Bark "Anglo—Norman," (left Amoy October 31, passed Cape of Good Hope, January 7th,) no date 20° S., 70° E., "cyclone travelling SSW., barometer 28.66, hove to 36 hours, under bare poles, terrific sea washing decks. *Bay of Bengal*—No. I (see chart No. IV) probably formed over the Gulf of Martaban from *November* 12th to 17th; on the 17th the lowest pressure was southwest of Burmah, with E. gales and rain at Diamond Island; on the morning of the 21st it was east of Masulipatam, and heavy rains, with thunder and lightning from the E., prevailed along the coast northwards. The S.S. "Mira" (at Calcutta, Nov. 20th) reported bad weather from 10° N. 84° E. to 15° N. 86° E. No. II. On November 29th rain and moderate squalls were suspected to the south or southeast of Cape Negrais, with strong E. winds at Diamond Island;

30th, doubtful weather was indicated from Cape Negrais and the Andamans to the opposite coast of Madras; *December* 1st to 4th, falling pressure and cloud and rain prevailed on the Coromandel coast, and on the 5th a well-defined depression appeared, which moved northward on the 6th and 7th; very heavy rains fell during these days to the northeast of the storm-centre, the excessive amount of 21.2 inches being recorded at Vizagapatum during the 48 hours preceding 10 a. m. of the 8th; at this place the wind veered from NE. to SSE. and S. After this storm the northeast monsoon probably became fully established over the bay.

TEMPERATURE OF THE AIR.

The isothermal lines on chart No. II illustrate the general distribution of air for the month. By reference to the table on the left side of the chart it will be seen that the temperature of the present month has been very generally below that of the mean for several years past, east of the Rocky mountains, the deviation averaging from two to three degrees, except over New England and the St. Lawrence valley, where it is from four to six degrees below. Over the Western Plateau the temperature has been decidedly above the normal.

Minimum and Maximum Temperatures, respectively: *Maine*—Orono, —10° and 43°; Eastport, 0°, 46°; Portland, 6°, 45°. *New Hampshire*—Mt. Washington, —23°, 14°; Dunbarton, —10°, 46°. *Vermont*—Burlington, —7°, 38°; Newport, —26°, 36°. *Massachusetts*—Rowe, —6°, 36; Boston, 4°, 56°; Springfield, 4°, 47°. *Rhode Island*—Newport, 10°, 48°. *Connecticut*—New London, 8°, 49°; Colebrook, —4°, 46°; Southington, 0°.4, 51°. *New York*—Madison Bks., —25°, 40; Plattsburg Bks., —16°, 35°; Schroon Lake, —20°, 38°; Buffalo, —2°, 43°; New York city, 8°, 49°; Rochester, —2°, 46°. *New Jersey*—Princeton, 1°, 55°; Atco, 8°; 63°. *Pennsylvania*—Tioga, —13°, 42°; Philadelphia, 8°, 60°; Pittsburg, 4°, 54°; Catawissa, 1°, 46°. *Delaware*—Dover, 14°, 62°. *Maryland*—Woodstock, 7°, 55°; New Market, 10°, 50°; Baltimore, 12°, 58°. *District of Columbia*—Washington, 11°, 58°. *Virginia*—Wytheville, 6°, 65°; Snowville, 10°, 48°; Lynchburg, 17°, 57°; Norfolk, 22°, 70°. *West Virginia*—Helvetia, —4°, 60°; Morgantown, 12°, 60°; Wellsburg, 2°, 48°. *North Carolina*—Highlands, 11°, 57°; Weldon, 24°, 75; Wilmington, 23°, 72°. *South Carolina*—Aiken, 26°, 69°; Charleston, 30°, 72°. *Georgia*—McPherson Bks., 14°, 71°; Savannah, 31°,74°; Augusta, 27°, 74°. *Florida*—Key West, 56°, 82°; St. Marks, 29°, 71°; Houston, 34°, 78°. *Alabama*—Green Springs, 20°, 72°; Mobile, 34°, 75°; Montgomery, 28°, 73°. *Mississippi*—Brookhaven, 26°, 69°; Vicksburg, 24°, 76°. *Louisiana*—Okalooska, 26°, 78°; New Orleans, 38°, 75°; Shreveport, 25°, 80°; *Texas*—Concho, 18°, 85°; Indianola, 36°, 75°; San Antonio, 32°, 88°; Castroville, 32°, 91°: Terril, 22°, 74°. *Ohio*—Ruggles, —6°, 53; Columbus, 4°, 56°; Cincinnati, 6°, 61°; Toledo, 4°, 48. *Kentucky*—Louisville, 6°, 65°; Bowling Green, 5°, 66°. *Tennessee*—Nashville, 11°, 67°; Memphis, 16°, 69; Chattanooga, 16°, 69°. *Arkansas*—Mt. Ida, 18°, 74°, *Michigan*—Alpena, —22°, 40°; Marquette, —20°, 39°; Detroit, —3°, 42; Northport, —10°, 38°. *Indiana*—St. Meinrad, —9°, 62; Indianapolis, —1°, 58°; New Harmony, —2°, 61°. *Illinois*—Rockford, —22°, 44°; Louisville, —4°, 60°; Chicago, —6°, 51°; Cairo, 8°, 67°; *Missouri*—Frankford, —8°, 62°; Kansas City, 1°, 75°; St. Louis, 4°, 65°. *Kansas*—Ft. Leavenworth, —3°, 71°; Ft. Wallace, 2°, 84°; Dodge City, 6°, 74°. *Wisconsin*—Neilsville, —36°, 38°; Ashland, —30°, 29°; Madison, —12°, 46; La Crosse, —21°, 45°. *Iowa*—Nora Springs, —20°, 43°; Des Moines, —12°, 52°; Vail, —16°, 57°. *Nebraska*—Norfolk, —16°, 67°; Omaha, —9°, 60°; North Platte, —13°, 47°; Ft.Sidney, —13°, 69°. *Indian Territory*—Ft. Sill, 16°, 79°; Ft. Gibson, 14°, 77°. *Minnesota*—Breckenridge, —34°, 39°; St. Paul, —22°, 35°. *Dakota*—Pembina, —44°, 30°; Yankton, —17°, 62°; Bismarck, —26°, 74°. *Colorado*—Pike's Peak, —21°, 26; Denver, —3°, 72; Ft. Lyons, —10°, 83°. *New Mexico*—Santa Fe, —3°, 75°; Ft. Union, —13°, 74°; Ft. Craig, 14°, 82°. *Wyoming Territory*—Cheyenne, —6°, 59°; Ft. Fred. Steele, —20°, 55°. *Montana*—Virginia City, —9°, 50°. *Utah*—Salt Lake City, 8°, 68°. *Nevada*—Winnemucca, 7°, 69°; Pioche, 5° 69°. *Idaho*—Boise City, —9°, 64°. *California*—Sacramento, 33°, 73°; Visalia, 32°, 79°; Los Angeles, 38°, 80; San Francisco, 43°, 70°; Red Bluff, 31°, 76°; San Diego, 38°, 74°.

Ranges of Temperature.—The *monthly ranges* will appear from an examination of the minima and maxima just given. Greatest *daily ranges* vary in New England from 27° at New London and 32° at Eastport to 34° at Boston; Middle States, 17° at Cape May and 27° at Albany to 33° at Cape Henry; South Atlantic States, 23° at Savannah, Smithville, Cape Lookout and Cape Hatteras to 37° at Augusta; Gulf States, 14° at Key West and 18° at Galveston to 33° at Montgomery and Corsicana; Ohio valley and Tennessee, 25° at Indianopolis to 41° at Cincinnatti and 35° at Morgantown; Upper Lake region, 27° at Chicago and Grand Haven to 36° at Marquette and Escanaba; Lower Lake region, 23° at Sandusky to 35° at Rochester; the Northwest, 26° at Davenport to 47° at Yankton and 45° at Pembina; Eastern Slope, 39° at Fort Gibson to 41° at North Platte; Rocky Mountains, 22° on Pike's Peak to 44° at Denver and 43° at Santa Fé; Western Plateau, 27° at Salt Lake City to 35° at Winnemucca; California, 20° at San Francisco to 30° at Los Angeles and Visalia and 28° at Red Bluff and Sacramento.

Frost—has occurred quite frequently over the northern sections of the country; in the interior of the Southern States and Texas from the 1st to 4th, 6th to 10th, 13th to 24th, 27th, 28th; along the immediate Gulf coast on the 3rd, 4th, 8th, 9th, 14th, 19th, 20th, 21st, 27th, 28th; and on the Pacific coast, 1st, 2nd, 3rd, 5th, 6th.

Ice formed in the Gulf, South Atlantic and Pacific States as follows: Charlotte, N. C., 17th; Charleston, 2nd, 3rd; Augusta, 21st, 22nd, 27th, 28th; Denison, Tex., 6th, 7th; Gatesville, Tex., 3rd, 6th, (8th, "intensely cold, ice all about,") 13th, 14th, 18th; Melissa, Tex., 3rd, 15th, 25th, ¼ inch; Wilmington, N. C. 21st; Brookhaven, Miss., 2nd, 3rd, 8th, 9th, 14th 15th, 19th, 20th, 27th, 28th; Fayettee, Miss., 3rd, 19th, 27th; Gainesville, Ga., 17th, ½ in.; Sacramento, Cal., 5th, 6th.

Ground frozen.—Green Springs, Ala., 14th, 27th, 28th; Brookhaven, Miss., 14th, 15th, 27th; Eagle Pass, Tex., 7th.

PRECIPITATION.

On chart No. III is illustrated the general distribution of precipitation for the month. On the left side is a table showing a comparison of the present month with several previous Februarys, from which it will be seen that there has been a general deficiency, except in the Upper Lake region and Minnesota and on the Pacific coast; at Portland, Or., and Olympia, Wash. Ty., the excess has been nearly equal to the average February rainfall.

Special Heavy Rains.—3d and 4th, Wickenburg, Arizona, 2.14 inches. 11th, Smithville, N. C., 2.63; Fayetteville, N. C., 4.25 in. 16th and 17th, Chattanooga, 2.54; Fayetteville, N. C., 16th to 18th, 4.00 in. 22d, Okalooska, La., 2.40 in. 22d and 23d, Vicksburg, 2.15.

Largest Monthly Rainfalls.—Olympia, Wash. Ty., 15.59 inches; Portland, Or., 13.22; Fayetteville, N. C., 10.13; Mt. Washington, 7.01; White Plains, N. Y., 6.47; Gainesville, Ga., 6.18; Chattanooga, Tenn., 5.85; Vicksburg, 5.63; Knoxville, 5.61; Cape Hatteras, N. C., 5.09; San Francisco, 4.90; Smithville, N. C., 4.76; Cape Lookout, N. C., 4.68; Charleston, 4.56.

Smallest Monthly Rainfalls.—Jacksboro, Tex., none; Ft. Lyon, Col., 0.04 inches; Pilot, Tex., 0.05; Concho, Tex., 0.06; Dodge City, Kan., 0.08; Camp Verde and Florence, Arizona, 0.14; Vail, Ia., 0.15; Pioche, Nev., 0.17; Stockton, Tex., 0.18; Cheyenne and Ft. Hays, Kan., 0.20; Winnemucca, Nev., and Fort Sill, Ind. Ty., 0.21; Santa Fe, N. M., 0.23; Fort Snelling, Min., 0.24; Fort McPherson, Neb., 0.26; Castroville, Tex., 0.29; Visalia, Cal., Ft. Craig, N. M., Morristown, Dak., and Ft. Union, N. M., 0.30; Phœnix, Arizona, 0.34; Graham, Tex., 0.35; Ft. Fred Steele, Wy. Ty., and Yankton, Dak., 0.36; Denver, 0.39; Warrensburg, Mo., 0.13; Macon, Mo., 0.25; Phelps City, Mo., 0.22; Grand City, Mo., 0.20; and northwestern portion of Iowa generally less than 0.50.

Drought.—Uvalde, Tex., 26th—Sheep owners report this month the most severe known, many sheep and goats have died from cold and starvation; vegetation is backward and nearly all springs are dry.

Hail.—Ft. Fred. Steele, Wy. Ty., 15th; Morristown, Dak., 28th; New Bedford, Mass., 26th; Freehold, N. J., 25th, 26th; Flushing and Cape Vincent, N. Y., 26th; Wilmington, N. C., 8th, 18th; North Lewisburg, Ohio, 22d, 28th; Woodstock, Vt., 26th; Helvetia, W. Va., 11th; Boise City, Idaho, 14th; Ft. Sill, Ind. Ty., 14th; San Antonia, Tex., 23d; Castroville, Tex., 22d; Fredericksburg, Tex., 1st; Graham, Tex., 16th; Shreveport, La., 25th; Dubuque, Iowa, 24th; Logansport, Ind., 25th; Little Egg Harbor, N. J., 27th.

Rainy Days—The number of days on which rain or snow has fallen varies as follows: New England, 13 to 17; Middle States, 7 to 16; South Carolina States, 9 to 13; Gulf States, 2 to 12; Ohio valley and Tennessee, 10 to 20; Lower Lake region, 15 to 23; Upper Lake region, 14 to 18; Upper Mississippi valley, 12 to 15; Lower Missouri valley, 4 to 11; Eastern Slope, 0 to 13; Rocky Mountains, 2 to 11; Western Plateau, 1 to 14; Pacific coast, 6 to 11.

Cloudy days.—For New England the number varies from 9 to 18; Middle States, 7 to 14; South Atlantic States, 7 to 13; Gulf States, 2 to 12; Ohio valley and Tennessee, 8 to 18; Lower Lake region, 13 to 21; Upper Lake region 9 to 17; Upper Mississippi valley, 8 to 13; Lower Missouri valley, 9 to 11; Eastern Slope, 5 to 14; Rocky Mountains, 2 to 10; Western Plateau, 1 to 17; Pacific coast, 4 to 11.

Snow—.The precipitation in the northern sections occurred generally as snow. On the Pacific coast and in the South Atlantic States and Texas it occurred as follows: in *British Columbia*, on the 7th, 8th, (10th, 11th, "heaviest storm since 1861–2, and came according to cloud movement, from the SW; at Victoria the snow was four to five feet deep.") *California*, on the Coast Range mountains, 19th; on Sierra Nevada's, during the entire month; *Texas*, 1st, 2d, 14th; *North Carolina*, 1st, 8th, 11th, 12th, 13th, 14th, 15th, 16th, 17th, 20th; *Georgia*, 14th, 16th.

Depth of Snow on Ground at end of Month.—It varied in the different sections as follows: *New England*, trace to 38 inches, and 48 inches on Mount Washington. *Middle States*, 0 to ½ inch along the coast to 36 inches in the interior. *Ohio*, trace to 18 inches. *Lower Lakes*, 0 to 18 inches. *Upper Lakes*, 2½ to 30 inches. *Upper Mississippi Valley*, trace to 25 inches. *Indiana*, 0 to 10 inches. *Red River of the North Valley*, 4½ to 8 inches. *Missouri Valley*, 0 to 6 inches. *Rocky Mountains*, Cheyenne, Virginia City and Pike's Peak, 3 inches.

RELATIVE HUMIDITY.

The average percentage of relative humidity for the month ranges as follows: New England, 59 to 78; Middle States, 58 to 79; South Atlantic States, 57 to 78; East Gulf States, 69 to 76; West Gulf States, 56 to 77; Lower Lakes, 71 to 82; Upper Lakes, 70 to 78; Ohio valley and Tennessee, 59 to 73; Upper Mississippi valley, 66 to 74; Lower Missouri valley, 64 to 69; Red River of the North valley, 84; to 92; Eastern Slope, 50 to 91; Western Plateau, 48 to 67; California, 69 to 87. *High stations* report the following, not corrected for altitude: Mt. Washington, 85; Pike's Peak, 51; Santa Fe, 50; Cheyenne, 52; Denver, 57.

WINDS.

The prevailing winds at the Signal Service stations are shown by arrows on chart No. II, from an examination of which it will be seen that over the eastern section of the country they have been from northerly to westerly except where influenced by local causes; of which marked cases are seen in the NE. wind along

the North Carolina coast, the south wind at Burlington, Vt., and the east winds at Oswego and Grand Haven; opposing northerly and southerly winds have prevailed from Texas to Colorado and thence to Arizona. Northerly winds in California and southerly winds from Oregon to Utah and thence northward.

Total Movements of the Air.—The following are the *largest* monthly movements recorded at the Signal Service stations, viz: Pike's Peak, 21,218 miles; Sandy Hook, 13,101; Cape Lookout, 12,901; Cape May, 12,772; Woods Holl, 12,435; Indianola, 11,101; Barnegat, 10,161; Cape Hatteras, 10,095; Eastport, 9,722; Sandusky, 9,596; Cheyenne, 9,501; Breckenridge, 9,199; Milwaukee, 8,723; Grand Haven; 8,529. The *smallest*: Deadwood, Dak., 1,726 miles; Visalia, Cal., 1,977; Nashville, 2,591; Los Angeles, Cal., 2,607; Walde, Tex., 2,635; Fredricksburg, Tex., 2,948; Indianapolis, 3,029; Lynchburg, 3,105; Ft. Craig, N. M., 3,178; San Diego, 3,294; Salt Lake City, 3,336; Ft. Davis, 3,429; Dubuque, 3,473; Augusta, 3,475; Shreveport, 3,500.

Local Storms.—Tornado at Riverdale, Caddo Parish, La. *February* 10th about 5 p. m. a black cloud resembling a water spout was observed moving from the SW. to SE. along the southern horizon apparently reaching to the ground and accompanied by thunder and lightning, hail and a terrible rumbling noise. The storm left a very clean path averaging about 100 yards in width, uprooting and in many places twisting off at the stump trees of from three to four feet in diameter. It prostrated at least 3,000 panels of fence, demolished two cabins carrying a portion of one of them across the river and scattering the remainder a distance of 100 yards The tornado then crossed the river throwing the water to a great height. On the Sunny Point Plantation it blew a dwelling house off the blocks on which it rested, carrying it ten feet and setting flat on the ground. Cabins, dwelling and gin house damaged to the amount of $1,000. The large gin house was twisted into two parts one of which was carried across the river on the Hamilton Plantation, and the other blown into the river. A new wagon was snatched up by the whirling storm and smashed into pieces; a piece of hewn timber ten by sixteen inches and forty feet long was carried a quarter of a mile. On the Hamilton plantation two cabins were demolished and two persons injured, the storm then disappeared in the swamp.

VERIFICATIONS.

Indications.—The detailed comparison of the tri-daily weather Indications with the telegraphic reports for the succeeding twenty-four hours, show the general percentage of omissions to be 0.9 per cent., and of verifications to be 92.2 per cent. The percentage of verifications for the four elements have been: weather, 95.9; wind, 93.6; temperature, 91.9; barometer, 90.2. The percentage of verifications by geographical districts have been: New England, 93.8; Middle States, 94.1; South Atlantic States, 92.3; East Gulf States, 92.7; West Gulf States, 90.9; Lower Lake Region, 94.1; Upper Lake Region, 92.5; Tennessee and the Ohio Valley, 95.8; Upper Mississippi Valley, 92.1; Lower Missouri Valley, 91.4; Northern Pacific coast Region, 91.1: Central Pacific coast Region, 96.4; Southern Pacific coast Region, 83.9 Of the 3,437 predictions that have been made, 76 or 2.2 per cent. are considered to have entirely failed; 52 or 1.5 cent. were one-fourth verified; 237 or 6.9 per cent. were one-half verified; 36 or 1.1 per cent. were three-fourths verified; 3,036 or 88.3 per cent. were fully verified, so far as can be judged from the tri-daily weather maps.

Cautionary Signals.—143 Cautionary Signals were displayed, of which 135, or 94.4 per cent. were justified. 110 Cautionary Off-shore Signals were displayed, and of these 109 or 99.1 per cent. were justified as to direction; 98 or 89.1 per cent. were justified as to velocity. Of the Cautionary Off-shore Signals, 72 were changed from Cautionary. 253 signals of both kinds were displayed, of which 233 or 92.1 per cent. were fully justified. The above does not include signals ordered at 45 display stations where the velocity is only estimated and not measured. 40 cases were reported of winds of 25 miles or over where signals were not ordered.

NAVIGATION.

In the table, on right side of chart No. III, are given the highest and lowest readings, on the Signal Service river-gauges, during the month with dates of same.

Ice on Rivers and Lakes. Missouri.—Omaha, 28th, river frozen during month, ice giving away along banks, teams have ceased to cross, but foot passengers cross daily with safety. Leavenworth, 7th, ice in river weakening; 10th, ice gorge below city broke in the afternoon; 11th, 26th, river full of floating ice. Brunswick, river has been frozen over since December 20th; February 7th, ice began to move, melted gradually and caused no damage; river closed seven miles above here. *Kansas River.*—Kansas City, Mo., 1st to 9th, floating ice; 10th, river clear; 14th, ice moving until 4 p. m., then closed; 19th, river open; 26th and 27th, floating ice; 28th, river clear. *Magnoketa River.*—Monticello, Iowa, 1st, ice in river twenty-four inches thick. *Mississippi*—Muscatine, Ia., 10th, 12th, 14th, teams crossing on the ice, this has continued for the past fifty days. Keokuk, 24th, ice above the bridge nearly all broken and heaping up along the shores; ice south of the bridge yet solid. St Louis, heavy ice in river 1st, 2nd, 12th, 13th, 15th to 18th, 27th; light ice 3rd, 11th, 19th to 21st, 28th; river clear, 4th, 5th, 6th, 7th, 8th, 9th, 10th, 22nd to 26th; 14th, river full of floating ice, navigation temporarily suspended; 27th, heavy ice in river and running slowly; 18th, navigation resumed. La Crosse, 28th, river frozen during month, teams crossing continually. St. Paul, river frozen during month, teams crossing every day. Cairo, 15th, 16th, 17th, floating ice in river. *Ohio*—Wellsburg, West Va., 1st, navigation resumed; 6th, large quantities of shore ice, river almost clear of floating ice; 7th, clear of ice; 15th to 18th, full of floating ice, navigation suspended; 19th, full of floating ice, but steamers of the first class running; 22nd, navigation suspended except to first

class steamers; 28th, river rising and full of floating ice. Cincinnati, 2nd, drift-wood and floating ice in river; 14th, canal frozen over, shore ice forming along river; 18th, small quantities of soft ice in river; 19th, some ice in river but not enough to obstruct boats; 20th, considerable ice in river, boats found difficulty in forcing their way through it; 21st, heavy floating ice in river; 22nd, 23rd, small quantities of floating ice. *Tennessee River*—Chattanooga, 2nd, thick ice in river. *Miami River*—Cincinnati, 14th, floating ice in river. *Licking River*—Cincinnati, 14th, floating ice in river. *Alleghany River*—Pittsburg, 15th, 26th, 27th, 28th, large quantities of floating ice in river. *Monongahela River*—Morgantown, West Va., 16th, large quantities of floating ice in river. Pittsburg, 26th, 27th, 28th, floating ice in river. *Susquehanna River*—Catawissa, Pa., north branch closed during the month, ice eight to ten inch thick. *Delaware River*—Trenton, N. J., ice in river broken up, having been closed for 46 days; 15th, river frozen again. *Hudson River*—Garrisons, N. Y., 28th, river still closed with ice. *New Jersey Coast*—Long Branch, 11th, the vast field of ice which has filled the "Horseshoe" for over a month has been moving away gradually for the past two days. Last night the remaining portion, containing many thousand acres, moved slowly out with the tide. *Flushing Bay*—Flushing, N. Y., 13th, bay open, tug boat passed through with cargo of coal; 15th, bay closed; 26th, reopened by a channel being sawed through the ice, tug boat arrived with coal; 28th, another boat arrived with coal. *Deerfield River*—Rowe, Mass., 12th, ice passed out. *Otta Quechee River*—Woodstock, Vt., 12th, breakiug up; 13th, river clear. *Lake Superior*—Duluth, 1st to 5th, harbor frozen over, and also lake as far as the eye can reach, average thickness fourteen inches; Marquette, 5th, ice in harbor. *Lake Michigan*—Grand Haven, 26th, lake frozen as far as the eye can reach, though the Milwaukee boats still keep a channel through it. *Grand Traverse Bay*—Northport, Mich., bay all open outside of harbor. *Grand River*—Grand Haven, Mich., river still full of floating ice. *Lake Geneva*—Bloomfield, Wis., 4th, ice twenty-five inches thick. *St. Clair River*—Port Huron, Mich., 13th, ice so thick that the Grand Trunk R. R. Co. are compelled to blast it by exploding sunken torpedoes, in order to make a passage for their ferry boats. *Detroit River*—Detroit, 2nd, ice along the shore. *Lake Erie*—Cleveland, 1st, large floes of floating ice moved toward the shore by the prevailing NW. winds; 2nd, floating ice as far as the eye can reach; 4th, lake covered with floating ice; 8th, lake frozen out to a great distance, very thick near shore; 11th, ice firm on lake; 12th, ice breaking up; 15th, lake frozen; 17th, ice still firm; 18th, lake covered with ice; 22nd, ice breaking up. *Sandusky Bay*—Sandusky, 28th, ice in middle of bay twenty inches thick, loaded wagons and sleds crossed over to the Peninsula and Johnson's Island. *Lake Champlain*—West Charlotte, Vt., 1st, lake frozen over; 2nd, crossing on the ice; 4th, ice boats crossed; 10th, lake open near Four Brothers' Islands; 12th, open from Hillsboro Point, N. Y., to Hill Point, Vt., and north to the Islands; 15th, lake closed, people crossing; 16th, teams crossed for first time; 25th, cutting ice twelve inches thick. *Mt. Desert Sound*—Mt. Desert, Me., 1st, frozen over.

High Tides.—Cape Lookout, N. C., 8th, 19th.

TEMPERATURE OF WATER.

The *temperatures of water*, as observed in rivers and harbors, with average depth when observations were taken, are given in table on chart No. II. At Alpena, Buffalo, Burlington, Cleveland, Escanaba, Grand Haven, Sandusky and Toledo no observations were made on account of ice. At the following stations observations were only made on the dates indicated: Chicago, 1st, 13th, 17th to 25th, 28th; Detroit, 1st; Duluth, 1st to 5th; Marquette, 1st to 4th; Milwaukee, 8th to 17th; New York City, 6th to 13th, 20th, 21st and 26th.

ATMOSPHERIC ELECTRICITY.

Thunder-storms.—7th, Fla. 8th, Fla. 9th, Miss. 10th, Mo., Miss., La., Tex. 11th, Fla., W. Va., Ga., N. C. 14th, Idaho. 16th, Tex. 17th, Fla., Ala., La., Ga. 18th, Ala., Ga., La., N. C., Fla., S. C. 22nd, Ala., Ind., La., Miss., Tex., Mo., Ill., Tenn., Ky. 23rd, Fla., Miss., Tex., Ala. 25th, Ill., Ind., Tenn., Miss., La. 26th, Miss., Tex., Va. and Conn.

Auroras.—Monticello, Iowa, 22nd; Topeka, Kan., 2nd; Mechanic's Falls, Me., 13th; Cambridge, Mass., regularly looked for each evening at 8 p. m., except the 10th, but none seen; observations hindered by clouds on the 3rd, 5th, 6th, 11th, 16th to 20th, 22nd, 23rd, 25th, 26th; partially cloudy in the north, 1st, 13th, 27th; moonlight, 1st, 2nd, 4th, 7th, 8th, 27th, 28th; evenings on which the aurora might have been seen, if present, 9th, 12th, 14th, 15th, 21st, 24th; Atco, N. J., 28th; Cape Vincent, N. Y., regularly looked for each evening at 8 p. m., but none observed; Pembina, Dak., 11th, 14th; Coalville, Utah, 13th.

OPTICAL PHENOMENA.

Solar Halos.—1st, Iowa, Me., Ind. Ty. 2d, Iowa, Fla., Conn. 3d, Iowa, Me., Neb., Pa., Utah, Dak. 4th, Ind., Mich., Pa., Dak., Ohio, Ga. 5th, Ill., Iowa, Me., Mass., N. H., N. Y., Dak. 6th, Conn., Me., Mass. 7th, Conn., Me., Tex., Dak., Tenn. 8th, Kan., Utah, Dak., Tex., Min., N. M. 9th, Ind., Iowa, Mich., Miss., Ohio, N. C., Ga. 10th, Ill., Ind., Mich., Miss., N. J., N. Y., Ohio, Pa., Tex., Iowa, Dak., Ga., N. C., Va. 11th, Iowa, Me., Dak. 12th, Kan., Iowa, Neb., Dak., Minn., Ga. 13th, Ill., Iowa, Mich., Minn., Ga. 14th, Ill., Ind., Iowa, Miss., Neb., Tex., Dak. 15th, Ind., Iowa., Ill. 16th, Conn., Ia., N. J., N. Y., Pa., Ohio, Va. 17th, Me., Mich., N. Y., Vt., Dak. 18th, Mich, N. Y. 19th, Ill., Iowa, N. Y., Dak., Minn., Ga. 20th, Utah, Ohio, Ga. 21st, Neb., N. H., Nev., Iowa. 22d, Conn., Me., Miss., N. H., N. Y., Utah, Tex., Iowa, Ohio. 23d, Ill., Kan., Mass., Neb., N. H., Tenn., Dak., Iowa, N. C., Me. 24th, Ind., Mich. N. H., Ohio, Dak, Ga. 25th, Iowa, Neb., N. H., Dak., Ohio, Ga. 26th, Ill., Iowa, Neb., Tenn., Tex. 27th, Iowa, Ohio, Va., Neb., Tex., Tenn., Ga., Conn. 28th, Ill., Ind., Iowa, Mich., Ohio, Va., Dak., Tex., Tenn.

Lunar Halos.—1st, Me., Mich., N. H., N. J., N. Y., Pa,, Vt., Va., Wis., N. M., La., Dak., Minn., Tenn., Conn., R. I. 2d, Ala., Ill., Ind., Me., Mass., Mich, Miss., Neb., N. J., Ohio, Idaho, N. M., Dak.,Mo., Wis., Fla., Ga., R. I. 3d, Conn., Ill., Ind., Ia., Miss., Neb., N. J., N. Y., Cal., Ind. Ty., Dak., Tex., La., Mo., Wis., Ohio, Fla., Va. N. H. 4th, Neb., N. J., N. Y,, N., C., Pa., Va., Col., Kan, Dak., Wis., Ohio, Ga., Md., Conn., Mass., N. H., R. I., Me. 5th, Ia., Me., Neb., Pa., Va., Wis., Idaho, Ind. Ty., N. C. 6th,Ohio, Vt., Idaho., Tex., Wis., N. H., Me. 7th, Ia., Me., Cal., Col., Tex., Dak., N. M., Ohio, Va., N. H. 8th, Ind., Mo., Dak., Tex., Wis., N. M., Ohio, Ky., Tenn., Vt. 9th, Ill., Ohio, Tenn., Va., Dak., Ia., Mo., N.Y. 10th, Ind., Mich., Ohio., Tenn., Va., Dak. 11th, Kan., Neb., Dak. 12th, N. M. 14th, Mo., N. Y., Tex. 15th, Ind. 23d, Vt. 24th, Pa., Nev. 25th, Mo., Nev., Col., Ga. 26th, Ia , Mo., Neb., Va., Cal., Col., Tex. 27th, Ind., Mass., Neb., N. H., N. J., N. Y., Ohio, Pa., Va., Cal., Col., Tex., Tenn. 28th, Mich., N. Y., Ohio, Pa., Va., W.Va.

Mirage.—New London, Conn., 24th; Pembina, Dak., 15th.

MISCELLANEOUS PHENOMENA.

Botanical.—*Alabama*—Green Springs, in bloom, 1st, red maple, 20th, plums, 28th, peaches; 20th, quinces in leaf. *California*—Sacramento, in bloom, 16th, almond trees, 23rd, apricots, 28th, peaches and other fruit trees in bloom. Visalia, in bloom, 22nd, almond trees, 24th, peach. The past winter is considered to have been the severest on record throughout California, and the San Francisco Bulletin of February 13th, gives a very complete review by counties, of the reports of the owners of orange, lemon, lime and citron plantations. The uniform report is that in low valleys, and at a few extreme high elevations, the cold has been so severe as to injure or kill these trees, but that the vast majority of the plantations having been located on hillsides of moderate elevations, have not suffered seriously, and that the cultivation especially of orange and lemon is hereafter to be considered as no longer an experiment in California. The lowest temperatures recorded by thermometers were frequently not so destructive as the frosts that occurred when higher temperatures prevailed. Frequently severe winds intensified the injury due to low temperatures. *Florida*—Ft. Barrancas, in bloom, 2nd, peaches. Houston, in bloom, 10th, roses, 19th, wild plums, 21st peaches; 13th, farmers finished sowing oats; 25th, planting corn. *Georgia*—Forsyth, in bloom, 25th, peaches. St. Marys, in bloom, 10th, strawberries, 20th, peaches. Augusta, 15th, peach trees beginning to bloom; 24th, English peas up, and lettuce in the market. *Indiana*—St. Meinrad, 27th, peaches mostly killed; grass and wheat green and promising. *Iowa*—Ft. Madison 8th, horse-radish sprouting. *Kansas*—Cresswell, 18th, peach buds and trees killed. *Louisiana.*—Okalooska, in bloom, 27th, plums and violets; 28th, peaches beginning to bloom, all vegetation ten to fifteen days later than last year. *Michigan.*—Litchfield, 28th, peaches not killed, fair prospect for all kinds of fruit. *Mississippi.*—Brookhaven, in bloom, 1st, yellow jessamine, 17th, maple, 18th, plums; 20th, peach buds swelling; 12th, crab-apple leafing. Fayette, in bloom, 21st, pears, 22nd, chinese quince, wild violets, slippery elm; 24th, wild plum and pitch pine. *Missouri.*—Corning, 28th winter wheat in fine condition. Springfield, 28th rhubarb sprouting in the open air, blue grass and clover green, buds of early foliage bursting. Throughout the state complaints of injury to the peach crop are quite general. *Nebraska*—Clear Creek, 28th, farmers breaking and raking corn stalks preparatory to seeding. Howard, 28th, peach buds appear to be killed. *North Carolina.*—Fayetteville, in bloom, 1st, japonicas and jonquils, 11th, hyacinths, 17th, flowering maple, 23rd, apricot; 11th, wheat crop fine, fruit of all kinds so far uninjured. *Ohio.*—Bethel, 25th, maple sap running. *South Carolina.*—Aiken, in bloom, 24th, peaches and plums. *Tennessee.*—McMinnville, in bloom 16th, jonquils, lilacs budding. Chattanooga, in bloom, 21st, violets and crocus, 24th, forsythia. *Texas.*—Melissa, 28th, ground too dry for oats to sprout, wheat needing rain very much. Austin, 28th, in bloom, peach and plums. Terrill, 20th, commenced planting corn. Gatesville, in bloom 22nd, peach and elm, grass growing. *Virginia.*—Broad Oak, 28th, wheat and oats looking badly.

Birds.—*Martins*—Houston, Fla., 12th. *Blackbirds*—Dover Mines, Va., 22nd; Geneva, Neb., 22nd. *Geese*—Ft. Madison, Iowa, 11th, 24th; Oregon, Mo., 22nd, 23rd, 24th; Corning, Mo., 1st to 23th; Kansas City, Mo., 4th, 7th, 21st; Plattsmouth, Neb., 4th, 9th, 10th; Flushing, N. Y., 15th; Bethel, Ohio, 25th; Ringgold, Ohio, 25th; North Lewisburg, Ohio, 28th; Jacksonburg, Ohio, 28th; Melissa, Tex., 2nd, 18th; Dover Mines, Va., 23rd, 26th; Howard, Neb., 23rd; Sacramento, Cal., 4th, 7th, 16th; North Platte, Neb., 28th; Leavenworth, 22nd, large flocks; St. Marks, Fla., 22nd; Keokuk, 23rd; Lynchburg, Va., 7th. *Robins*—Topeka, Kan., 23rd; Sandy Springs, Md., 28th; Plattsmouth, Neb., 4th, (24th, in large numbers;) Flushing, N. Y., 16th, first appearance; Bellefontaine, Ohio, 2nd; Jacksonburg, Ohio, 25th; Ringgold, Ohio, 24th, 28th, in large numbers; Broad Oak, Va., 28th; Chattanooga, Tenn., 27th. *Woodpeckers*—Monticello, Iowa, 2nd, 15th, 24th. *Owls*—Monticello, Iowa, 1st, 6th; Uvalde, Tex., 16th. *Chickadees*—Monticello, Iowa, 9th, 20th, 23rd. *Prairie Chickens*—Corning, Mo., 1st to 28th. *Ducks*—Corning, Mo., 1st to 28th; Beloit, Wis., 28th. *Bluejays*—Rowe, Mass., 22nd, 25th; Niles, Mich., 3rd, 5th; Oregon, Mo., 3rd, 6th. *Wax Wings*—Rowe, Mass., 1st, 2nd, 4th, 7th, 13th, 17th, 22nd. *Bluebirds*—Somerset, Mass., 16th; Oregon, Mo., 3rd, 6th; Jacksonburg, Ohio, 5th; Melissa, Tex., 18th; Broad Oak, Va., 28th. *Hawks*—Corning, Mo., 1st to 28th. *Crows*—Corning, Mo., 1st to 28th; Linden, N. J., 10th, 28th; Princeton, N. J., 9th, 10th; Jacksonburg, Ohio, 28th. *Sparrows*—Bellefontaine, Ohio, 28th; Augusta, Ga., 27th. *Mocking Birds*—Melissa, Tex., 24th; Fayette, Miss., 28th. *Cedar Birds*—Dover Mines, Va., 15th to 28th. *Redbird.*—Oregon, Mo., 1st, 9th, 16th, 20th; Melissa, Tex., 22nd. *Meadow Larks*—Fallston, Md., 23rd.

Miscellaneous.—*Frogs piping*—Louisville, Ill., 24th; Weldon, N. C., 11th, 25th. *Mosquitos*—Weldon, N. C., 25th. *Locusts*—Creswell, Kan., 23d. *Butterflies*—Fayette, Miss., 19th, 21st., 22d. *Bees*—Anna, Ill., 3d; St. Meinrad, Ind., 27th, young bees; Afton, Iowa, 21st; Litchfield, Mich., many swarms killed by the severe cold; Oregon, Mo., 2d, 3d, 7th, 21st; North Lewisburg, Ohio, 25th.

Meteors.—New Corydon, Ind., 14th, 18th; Cresco, Ia., 17th; Ft. Dodge, Ia., 19th; Woodstock, Md., 9th; Fayette, Miss., 1st, 19th, 24th, 27th; Clear Creek, Neb., 6th, 8th; Hector, N. Y., 15th; Palermo, N. Y., 15th; Ft. Davis, Tex., 20th, 8 p. m., very bright meteor, with long trail, from northeast to southeast of station, also on the 25th; Punta Rassa, 18th, unusual number observed moving from NE. to SW; North Lewisburg, Ohio, 28th; Wytheville, Va., 14th; Indianola, Tex., 21st, 7:20 p. m., very brilliant meteor about 25° from zenith, moving to the SE.; length of path 30° or 35°; exploded at about middle of path; duration, five or six seconds; Knoxville, 26th, 9:40 p. m., very bright meteor observed 55° above the south horizon, moving SW., disappearing at about 25° above horizon; Atlantic City, N. J., 14th, 9:30 p. m., very brilliant meteor descended from a point 20° NE. of zenith; no train or fragments. Iowa, on the 17th, at 7:30 p.m., a very bright meteor was seen in Howard, Gasper and Wayne counties.

Zodiacal Light.—Southington, Conn., 9th, 12th, 15th, 21st, evenings; New Corydon, Ind., 8th, 9th, 13th, 14th, 22d, 23d, evenings; Cresco, Iowa, 8th, 13th, 14th, 15th, 16th, 21st, 22d, evenings; Monticello, Iowa, 8th, 13th, 14th, evenings; Mechanics Falls, Me., 19th, evening; Cambridge, Mass., regularly looked for each evening at 8 p. m., except the 10th; visible 9th, 12th, 13th, 14th, 15th, 21st; observations hindered by moonlight or clouds, 1st to 8th, 11th, 16th to 20th, 22d to 28th; Somerset, Mass., 9th, 10th, 12th, 14th, 15th, 21st, evenings; Fall River, Mass., 8th, 9th, 14th, 15th 16th, evenings; Rowe, Mass., 14th, 15th, 19th, evenings; Corning, Mo., 8th, 13th, 20th, 22d, evenings; Oregon, Mo., 13th, 14th, 19th, 20th, 23d, evenings; Clear Creek, Neb., 8th, 9th, 13th, 14th, 19th, 21st, 22d, 23d, evenings; Contoocookville, N. H., 8th, 12th, 19th, 21st, evenings; Freehold, N. J., 21st, evening; Atco, N. J., 8th, 9th, 14th, 15th, 18th, 21st, 23d, 28th, evenings; hindered by clouds or moonlight, 1st to 7th, 10th, 11th, 12th, 13th, 16th, 17th, 19th, 20th, 22d, 24th, 25th, 26th, 27th; Princeton, N. J., 8th, 21st, 23d, evenings; Waterburg, N. Y., 9th, 13th, 14th, 15th, 16th, 21st, 22d, evenings; Argyle, N. Y., 13th, 14th, 15th, 21st, evenings; Cape Vincent, N. Y., 24th, 27th, 28th, evenings; Fayetteville, N. C., 12th, 13th, 14th, 18th to 21st, evenings; Bellefontaine, Ohio, 9th, 15th, 22d, evenings; New Ulm, Tex., 8th, 12th, 19th, 20th, 26th, evenings; Wytheville, Va., 13th, 14th, 15th, 18th, 21st, 23d, evenings; Pikes Peak, looked for, but not observed, 1st to 19th, 22d, 23d, 25th, 26th, 28th; observed on the 20th, 21st, 27th, evenings; 24th, in the morning; Colorado Springs, looked for, but not observed, 1st to 28th; Keokuk, 9th; New Haven, Conn., 24th, evening; Mt. Washington, looked for, but not observed, 1st, 2d, 3d to 28th. In Iowa it was observed on ten evenings.

Polar Bands.—New Corydon, Ind., 9th, 22d; Gardiner, Me., 1st, 7th, 22d, 25th; Oregon, Mo., 14th; Clear Creek, Neb., 3d, 4th, 8th, 9th, 15th, 18th, 19th, 22d, 27th; Freehold, N. J., 3d, 14th, 21st, 24th; Vineland, N. J., 27th; Thornville, Mich., 3d, 24th, 27th; Wytheville, Va., 7th, 9th, 10th, 14th, 16th, 26th, 27th; Fancy Gap, Va., 27th, Pembina, Dak., 3d

Prairie and Forest Fires.—Houston, Fla., 22nd, 27th; Creswell, Kan., 7th, 8th, 9th, 11th, 12th, 13th, 14th, 17th to 22nd. 24th, 26th, 27th, 28th; Colorado Springs, Col., 24th; Dodge City, Kan., 21st; Yankton, 2nd, 3rd, 7th, 8th, 9th, 10th, 22nd, 23rd, 28th; Corsicana, Tex., 22nd, 26th; St. Marks, Fla., 1st; Independence, Kan., 2nd, 3rd, 9th, 11th, 12th, 14th, 19th to 28th; Graham, Tex., 8th, 9th, 10th, 22nd, 23rd, 24th, 27th.

Earthquakes.—*January*—U. S. Naval Hospital, Yokohama, Japan, 3rd, 9h. 58′ a m., sharp shock, lasting three seconds. *February*—Visalia, Cal., 4th, 0h. 8′ a. m., shock lasting five seconds, preceded by peculiar rumbling noise; 0h. 8′ 7″ a. m., second shock, much heavier than first, lasting nine seconds; the motion appeared to come from the SE. or E. This shock was felt all over the surrounding country, in many places cracking the walls and upsetting the furniture.

Sunsets.—The characteristics of the sky at sunset, as indicative of fair or foul weather for the succeeding twenty-four hours, have been observed at all Signal Corps stations. Reports for 124 stations show 3,435 observations to have been made, of which 57 were reported doubtful; of the remainder 2,825, or 82.2 per cent., were followed by the expected weather.

Sun Spots.—The following monthly record of observations by Mr. D. P. Todd, Nautical Almanac office, Washington, D. C., is communicated by Prof. S. Newcomb, U. S. Navy, in charge of that office:

February, 1879.	No. of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		Remarks.
	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	Groups.	Spots.	
3rd, 3 p. m.	0	0	0	0	0	0	0	0	
4th, 2 p. m.	0	0	0	0	0	0	0	0	
7th, 4 p. m.	0	0	0	0	0	0	0	0	
8th, 3 p. m.	0	0	0	0	0	0	0	0	
13th, 2 p. m.	0	0	0	0	0	0	0	0	
14th, 3 p. m.	1	2	0	0	0	0	1	2	
15th, 2 p. m.	0	0	0	0	0	0	1	2	Spots small and faint.
18th, 3 p. m.	0	0	0	0	0	0	0	0	
20th, 3 p. m.	0	0	0	0	0	0	0	0	
21th, 3 p. m.	0	0	0	0	0	0	0	0	
25th, 3 p. m.	0	0	0	0	0	0	0	0	
27th, 3 p. m.	0	0	0	0	0	0	0	0	
28th, 3 p. m.	0	0	0	0	0	0	0	0	

Mr. William Dawson, at Spiceland, Ind., examined the sun on the following days, but observed no spots: 2nd, 3rd, 4th, 7th, 8th, 9th, 13th, 18th, 20th, 22nd, 23rd, 26th, 27th and 28th; on the 14th four spots and one group were seen, 15th, seven spots and one group, 25th, four spots and one group. Mr. David Trowbridge, at Waterburg, N. Y., examined the sun on the 7th, 8th, 9th, 10th, 14th, 15th, 19th, 24th, 27th and 28th, but observed no spots. Mr. H. D. Gowey, at North Lewisburg, Ohio, reports no sun-spots during

the month. Prof. Gustavus Hinrichs, of Iowa City, Iowa, observed the sun's disk on fourteen days, but saw no spots. Observations were also continued at Fort Whipple, Va., but no spots reported.

NOTES AND EXTRACTS.

Dr. Köppen, of the *Deutsche Seewarte*, publishes the following note on the mean pressure of the atmosphere in the interior of Asia: "The two most important features in the geographical distribution of the mean pressure of the atmosphere are, first, the maximum which through the whole year lies in the neighborhood of 30° to 35° north (and south) latitude on the oceans and the west coasts of the continents; and, 2nd, the inverse relations of the continents and oceans of the temperate zones, especially the winter maximum of pressure in the interior of the continents. While there is little difficulty in determining the details of the first-named feature, since it comes directly to the knowledge of every observing navigator and without further discussion of his observations, although its theoretical explanation still leaves much to be desired—yet in respect to the the second feature it is quite the reverse. The origin of this feature is easily understood as due to the great contrasts of temperature between the continents and neighboring oceans. For 40 years it has been known that the barometric pressure in southern Siberia averages twenty millimeters and more, less in summer than in winter. But on account of the entire absence of measures of altitude in Siberia, determined independently of atmospheric pressure, it was not possible to accurately determine the differences in the pressure in the interior and on the coasts, or to reduce the pressure in the interior to sea-level. This uncertainty has lately been removed by the results of the Levelling Expedition conducted eastward to the sea of Baikall, at the suggestion and under the direction of the Imperial Russian Geographical Association. Some of these results have been published by Woeikof, and show that all previous assumptions as to the high pressure in winter in southern Siberia, were considerably below the truth. Thus, the normal pressure for January, in the region east of Lake Baikall, becomes 778 millimeters, (30.63 inches,) or higher than any where else outside of Asia; and individual maxima above 800 millimeters, (31.50 inches,) frequently occur.

A Magnetic Storm occurred May 14th, of which accounts have been published from various stations where regular recording instruments are kept in action. It began as shown in the following table, where the times are reduced to Greenwich:

Name.	*Date.*	*Declination.*	*Horizontal Force.*	*Vertical Force.*
Greenwich	14th	6 h. 5 m., a. m.		
Stonyhurst	„	6 h. 4 m., a. m.		
Zikawei	„	6 h. 4 m., a. m.		
Melbourne	„	6 h. 20? m., a. m.		
Madison, Wis.	„	5 h. 58 m., a. m.	6 h. 3 m., a. m.	7 h. 8 m., a. m.

It is not stated how much the sluggishness of the recording magnet, or other instrumental error, may have affected these figures, but it is evident that the disturbance was nearly simultaneous throughout the world, and that any investigation into the origin of such disturbances will require the use of apparatus that will record to seconds of time rather than to minutes.

Observations of Temperature at Distant Places.—The following apparatus is adopted for keeping a record not only of underground temperatures, but by a slight modification it allows of observing the temperature of the air at points upon mountain-tops or in stationary balloons:

Several instruments have been contrived which, when buried in the earth, with wires coming from them to the surface, admit of having their temperatures observed by electrical means.

One of these is Siemens' resistance thermometer, another is Wheatstones telegraphic thermometer, of which a description will be found in the Report of the Dundee Meeting of the British Association; another is Becquerel's thermo-electric apparatus, which has been employed by its inventor and his son and grandson for some forty years. It is described in the following terms in the first Report of this Committee (1868):

"The thermo-electric method might also be followed with great advantage. Two wires, one of iron and the other of copper, insulated by gutta-percha or some other covering, as in submarine cables, and connected at their ends, might be let down so as to bring their lower junction to the point where the temperature is to be taken, their upper junction being immersed in a basin of water, and the circuit completed through a galvanometer. The temperature of the water in the basin might then be altered till the galvanometer gave zero indication."

Sir Wm. Thomson now adds the recommendation that, in carrying out this method, the two wires, each well covered with gutta-percha, should be twisted together; that the wires should be stout and as homogeneous as possible throughout, and that a piece of stout copper tube should be attached to the lower junction, this tube being uncovered and in close contact with the earth all round, its purpose being to insure that the junction takes the proper temperature.

It would probably be desirable, in filling up the bore, to mix clay with the original material to render it watertight, for it would be impossible to render the filling of the bore as compact as the surrounding rock.

Several pairs of wires would be buried in the same bore, with their lower junctions at different carefully-measured depths.

The upper junctions would be kept in a room provided with a steady table for a mirror-galvanometer.

Rain-fall.—A steady decrease in the depth of water in the upper portions of the Amazon has been observed of late years, so that navigation is sometimes impeded. It is suggested that this must be due to a general diminution of rain-fall in the interior of South America, such as has been observed in other countries in connection with cosmic-phenomena.

Barometer.—John Allan Broun communicates to *Nature* an extract from a forthcoming work on the diurnal oscillations of the barometer. Having carefully examined the law of these oscillations at Makerston, Dublin, Greenwich and Brussels, he concludes that the semi-diurnal oscillation is due to a cosmic cause, independent of local influences, while the diurnal oscillation shows that part of the solar action which is modified by atmospheric conditions not yet determined. The semi-diurnal oscillation is due to an action of the sun, which is repeated equally twice in each day like the solar oceanic-tide. The instrumental errors arising from unknown errors in the temperature and co-efficient of expansion of the mercury and brass and from other sources indicated by Wild, are apparently briefly referred to, and are probably quite sensible in amount and systematic periodicity in the four series here discussed.

Arctic Meteorology.—Lieutenant Weyprecht and Count Wilczek propose to spend at least one year in physical observations in Nova Zembla, or some other point on the north coast of Europe or Asia, and invite others to make similar observations simultaneous with their own.

The general results of the observations made by Mr. O. T. Sherman of the Howgate Expedition to Annanatook (latitude 66° 13′ 45″, longitude 67° 18′ 39″ W.) are given in the following table:

DATE.	Barometer reduced to Sea-level.	Temperature.			Sea-water Temperature.		Precip-itation.	Wind.		Cloudiness.
		Max.	Min.	Mean.	Surface.	18 feet below.	Inch.	Prevailing.	Mean h'rly velocity.	
1877—September	29.705	47.0	+28.0	+37.0	35	—	8.88	NW	5.5	0.89
October	29.743	35.2	+ 4.0	+22.8	30.0	—	1.07	NW	7.0	0.80
November	29.773	28.0	—10.0	+ 7.3	28.8	—	1.04	W	12.5	0.71
December	29.573	21.5	—41.0	—11.8	27.8	—	0.98	W	9.0	0.49
1878—January	29.595	21.5	—49.5	—17.6	28.2	—	0.5	W	4.2	0.44
February	29.724	11.5	—42.6	—18.0	29	29.2	0.49	W	3.3	0.65
March	29.823	35.8	—45.0	—13.7	—	—	0.5	W	4.8	0.62
April	29.903	35.4	—14.0	+10.4	—	—	0.77	W	6.7	0.60
May	29.961	48.5	— 8.0	+25.6	29	29.5	1.18	SE	6.2	0.76
June	29.790	55.3	+18.0	+34.9	31.8	31.1	1.85	W	6.6	0.79
July	29.753	52.8	+34.0	+40.0	38.2	32.4	4.18	SE	16.6	0.77
August										

Atmospheric Electricity.—The following extract from a memoir by Prof. J. D. Everett, of Belfast, presents views held by eminent electricians:

1. In discussions relating to the electrical condition of the air at a specified point, three things must be carefully distinguished: electrical density, electrical force, and electrical potential.

(*a.*) The electrical *density* at a point in the air is the quantity of electricity, per unit volume, with which the air at the point is charged.

(*b.*) The electrical *force* at a point is the force with which a unit of positive electricity would be acted on, if brought to the point without altering, by its inductive action, the previously existing distribution.

(*c.*) The electrical *potential* at a point is the work which would be done by electrical force upon a unit of positive electricity passing from the point to the earth, the movement of this unit being supposed not to disturb the pre-existing distribution.

2. Suppose an insulated conducting disc, several yards in diameter, to be fixed at the distance of one yard from a perfectly level surface forming part of the earth. Let the disc receive a positive charge, the intervening air being uncharged. Then the state of this intervening air, as regards the three particulars above distinguished will be as follows:

(*a.*) The electrical density will be zero at all points of it.

(*b.*) The electrical force at all points of it will be finite, and will be directed from the disc toward the earth.

(*c.*) The electrical potential will be nearly zero at points very near the earth, and will increase in approaching the disc, its value at points very near the disc being nearly as great as the potential of the disc, which is a constant quantity for all parts of the disc.

3. The electrical force will be nearly constant over all the region considered, except the circumferential portion. Leaving the circumferential portion out of account, and therefore regarding the force as constant, the potential at any point will be equal to the product of the force by the distance of this point from the surface of the earth; and the potential of the disc will be equal to the product of the force by the distance between the disc and the earth.

4. The general proposition, of which this is a particular case is that if we travel along a line of force from any point A to any other point B, the product of the mean force by the distance travelled is equal to the difference of potentials of A and B.

5. The definition of potential above given (1. (*a.*)) tacitly assumes the potential of the earth to be zero. Strictly speaking, we have no knowledge of absolute potential, but only of difference of potential.

6. In observations of atmospheric electricity, the element directly observed in potential,—the potential at a point in the air.

7. Instruments for the observation and measurement of potential are called *electrometers*, which are described in the *Annuaire de la Société Météorologique de France*, Vol. XXV, 1877, containing a comprehensive article on atmospheric electricity by M. Alfred Angot, entitled *L'Électricité atmosphérique, d'après les travaux de Sir W. Thomson et la Conférence de M. Mascart.*

8. In every electrometer, the potential which is directly measured is that of a certain insulated conductor forming part of the instrument. In order to measure the potential at a point in the air, we must first reduce this conductor to the potential which exists at that point. The apparatus for attaining this end is called a *collector.*

9. The most efficient collectors act by convection. A rapid discharge of matter is caused to take place from a projecting portion of an insulated conductor, and the matter, as it passes off, carries electricity with it until electrical equilibrium is attained.

10. In Sir William Thomson's water-dropping collector, a fine stream of water issues from the end of a long pipe; and the point in the air whose potential is attained is the point where the water ceases to be a continuous stream, and begins to be a succession of detached drops.

11. When a flame, or a discharge of hot smoke, is employed to collect electricity, the potential attained is that of the region where the hot gases have become just cool enough to lose their conducting power; for hot gas is a conductor, and cold gas is a non-conductor.

Sir William Thompson employs, in connexion with his portable electrometer, matches formed of blotting paper, steeped in nitrate of lead, dried, and formed into rolls with the aid of a little gum. They burn without flame, and are not extinguished by rain.

12. Some observers, notably Peltier, Quetelet, and Dellmann have adopted an altogether different mode of observing. Instead of observing the potential at a point in the air, they have observed the density of the electricity residing on an exposed conductor connected with the earth, or, to put the matter more simply, they have observed the charge residing on the earth's surface.

13. The theoretical connexion between the two modes of observation is as follows:—

Suppose a large open and level area on the earth's surface to be uniformly electrified. Then the lines of electrical force over this area will be vertical up to a considerable height, and the intensity of the force will be sensibly uniform at all heights, up to that at which the charge of electricity in the air beneath is of sensible magnitude in comparison with that on the surface of the earth. For, if we consider the space bounded by a vertical cylindrical tube of unit section, the charge residing on that portion of the earth which forms the base of the tube, together with the charge in the air within the tube up to any height, is equal to the force at this height, divided by 4π. If the force is uniform, the potential at any height is the product of the force by the height (Art. 3). The potential at a given point in the air near the earth will therefore vary directly as the charge on the earth's surface beneath it. The signs of these two quantities will, however, be opposite. If the charge on the earth's surface be negative, as is usually the case, the potential in the air will be less strongly negative, or more strongly positive than that of the earth, and is therefore to be reckoned positive when we assume the potential of the earth as zero.

14. The effect of irregularities on the earth's surface, including under the name "earth" trees, buildings, and all other conductors in communication with the ground, is to make the distribution of electricity over the surface unequal, in accordance with the law that the density is greatest on the projecting parts of a conductor. The potential at a given distance from the surface, if this distance is not too great, will be nearly proportional to the density, and will therefore be greatest over the projecting parts.

15. Some observers have employed a pointed conductor for collecting atmospheric electricity. In theory, an infinitely sharp point could retain no charge, and would therefore reduce the conductor to which it belongs to the potential of the air close to the point; but actual points fall short of attaining this end by sensible and uncertain amounts. A pointed collector cannot now be regarded as a scientific instrument.

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Albert J. Myer

Brig. Gen. (Bvt. Assg^{d}.) Chief Signal Officer, U. S. A.

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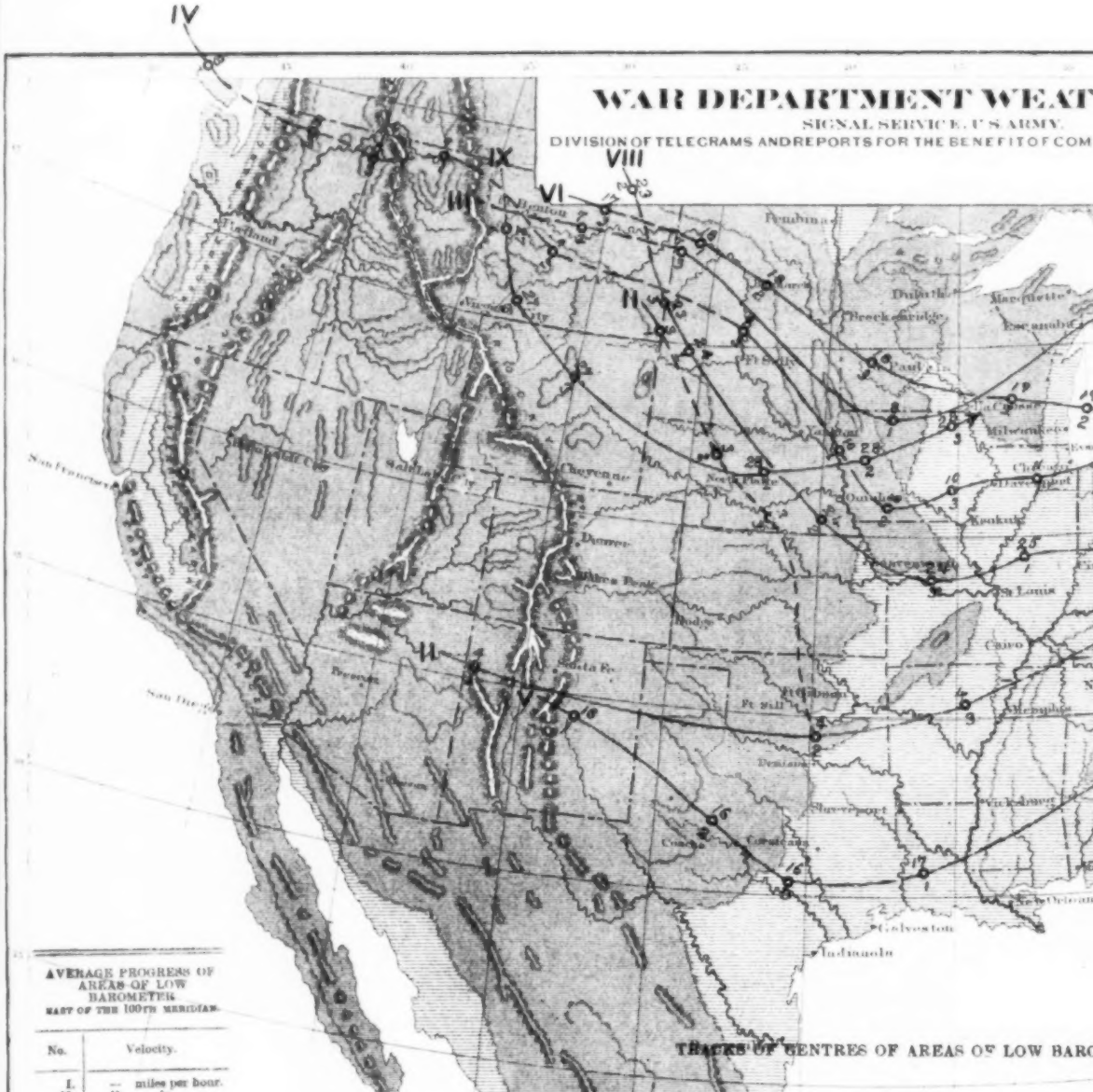
IV
WAR DEPARTMENT WEAT
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DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF COM
IX
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III
II
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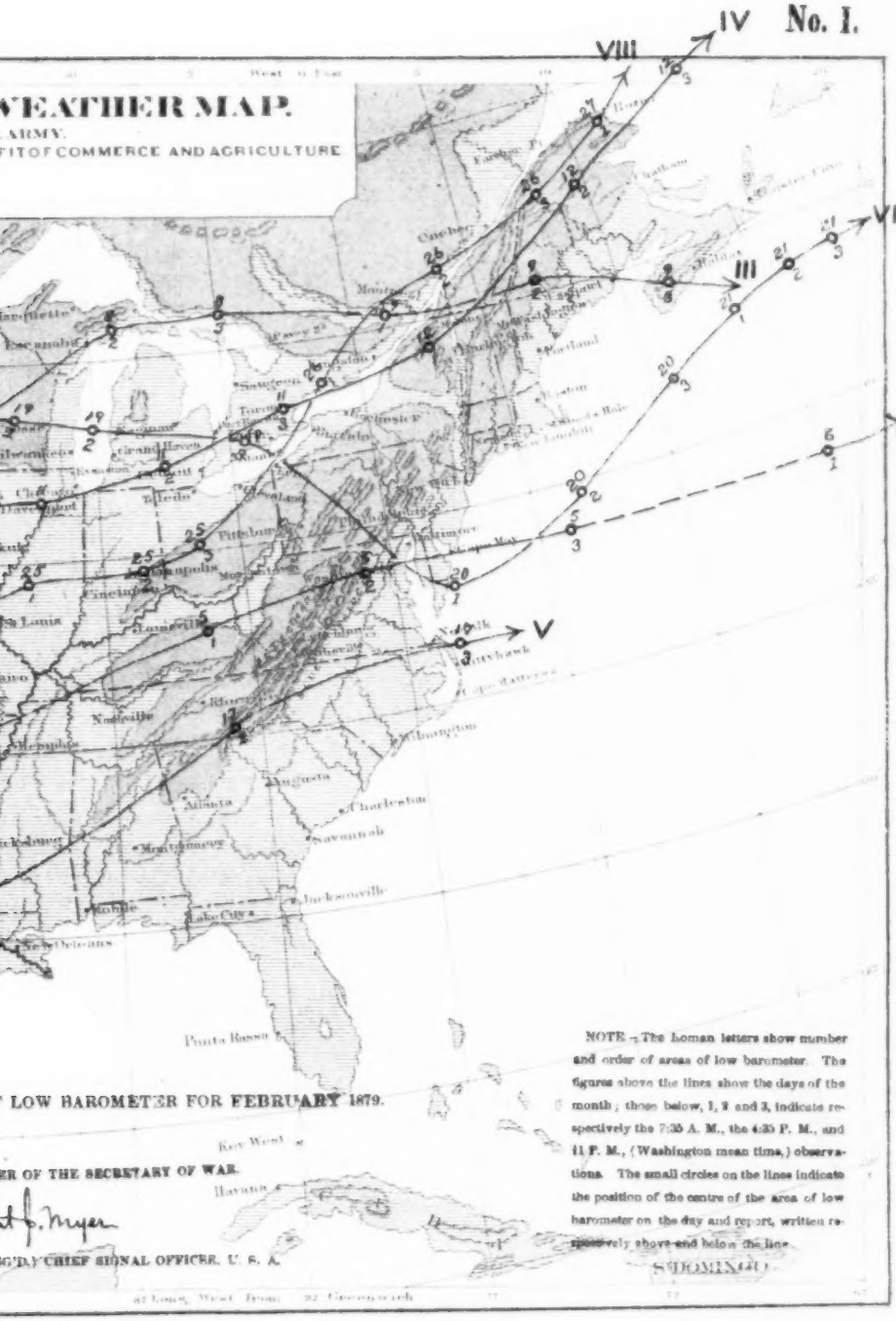
Vicksburg
Galveston
Indianola
AVERAGE PROGRESS OF AREAS OF LOW BAROMETER EAST OF THE 100TH MERIDIAN.
No. Velocity.
I. — miles per hour.
II. 45 do.
III. 40 do.
IV. 25 do.
V. 40 do.
VI. 35 do.
VII. — do.
VIII. 25 do.
IX. — do.
TRACKS OF CENTRES OF AREAS OF LOW BARO
PUBLISHED BY ORDER OF THE SE
Albert J. Myer
BRIG. GEN., (BVT. ASSG'D.) CHIEF S

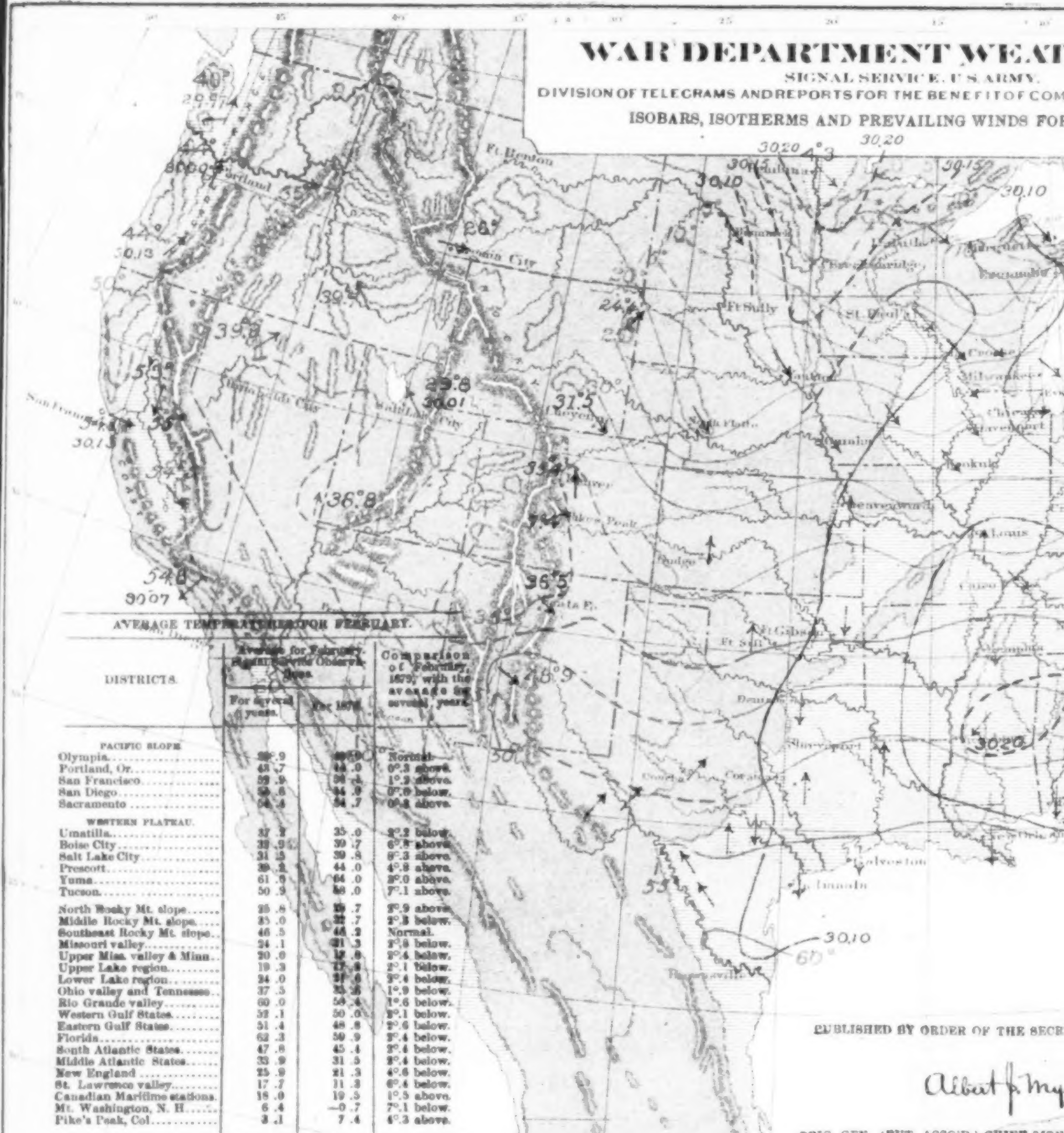
No. I.


VEATHER MAP.
ARMY.
FIT OF COMMERCE AND AGRICULTURE
VIII
IV
VI
III
II
V
NOTE.—The Roman letters show number and order of areas of low barometer. The figures above the lines show the days of the month; those below, 1, 2 and 3, indicate respectively the 7:35 A. M., the 4:35 P. M., and 11 P. M., (Washington mean time,) observations. The small circles on the lines indicate the position of the centre of the area of low barometer on the day and report, written respectively above and below the line.

LOW BAROMETER FOR FEBRUARY 1879.

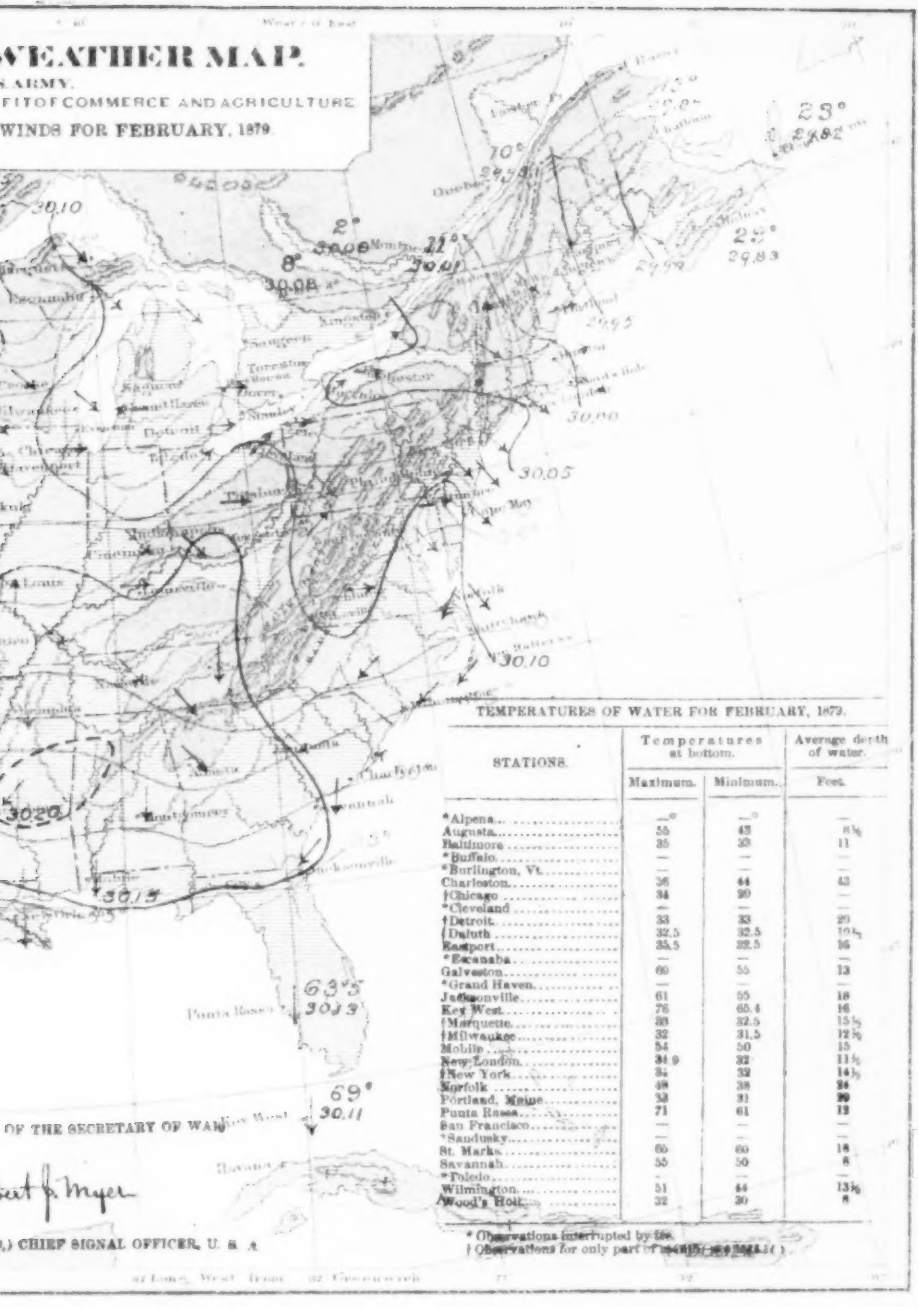
ER OF THE SECRETARY OF WAR.

G'D'Y CHIEF SIGNAL OFFICER, U. S. A.



AVERAGE TEMPERATURES FOR FEBRUARY.

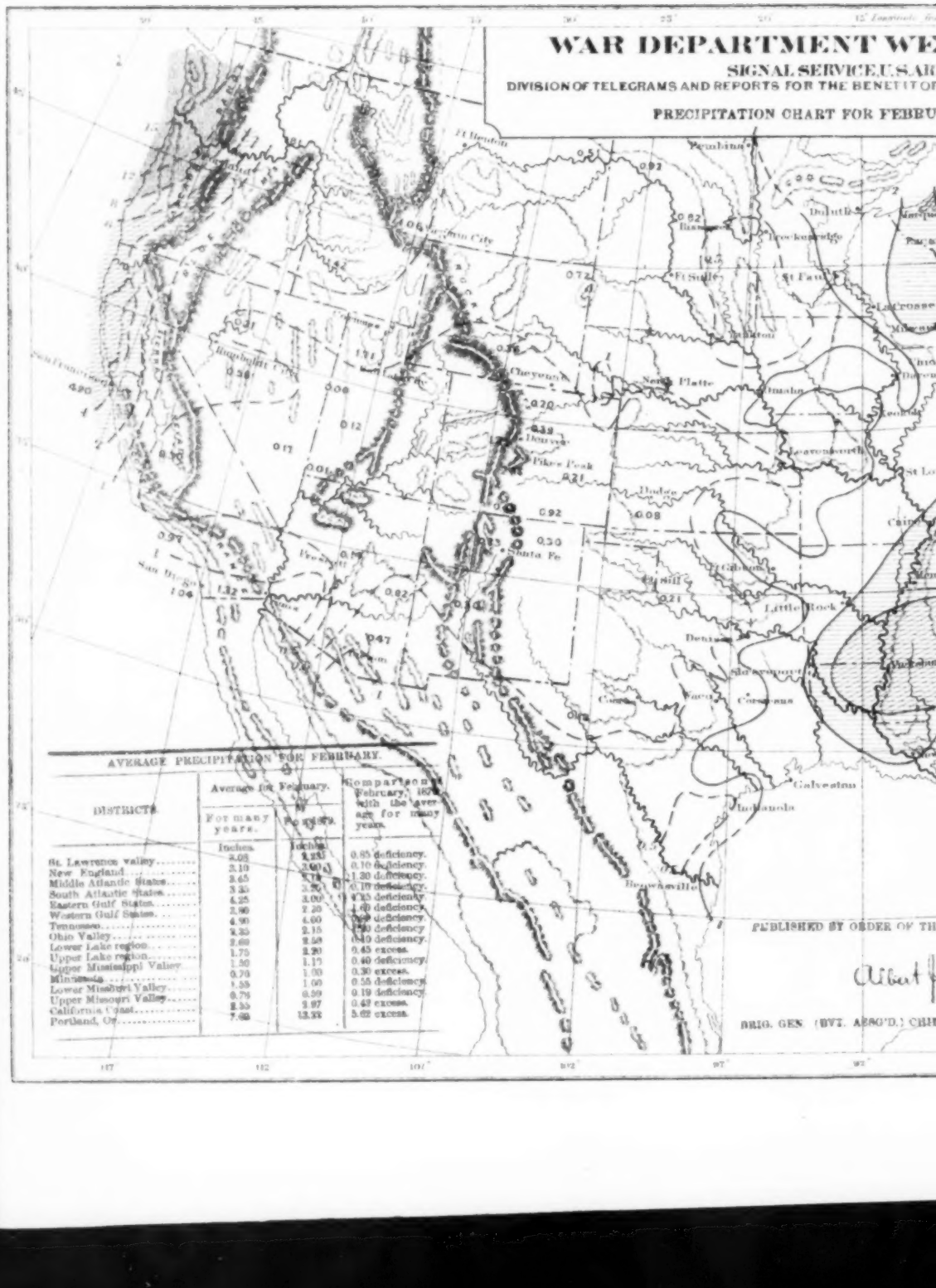
DISTRICTS.	Average for February, Signal Service Observations. For several years.	Average for February, Signal Service Observations. For 1879.	Comparison of February, 1879, with the average for several years.
PACIFIC SLOPE.			
Olympia	[illegible] .9	[illegible]	Normal.
Portland, Or.	43 .7	44 .0	0°.3 above.
San Francisco	53 .9	56 .1	1°.3 above.
San Diego	[illegible] .6	54 .0	0°.0 below.
Sacramento	54 .4	54 .7	0°.3 above.
WESTERN PLATEAU.			
Umatilla	37 .2	35 .0	2°.2 below.
Boise City	33 .9	39 .7	6°.8 above.
Salt Lake City	31 .5	39 .8	8°.3 above.
Prescott	39 .2	44 .0	4°.8 above.
Yuma	61 .0	64 .0	3°.0 above.
Tucson	50 .9	58 .0	7°.1 above.
North Rocky Mt. slope	25 .8	29 .7	3°.9 above.
Middle Rocky Mt. slope	25 .0	22 .7	2°.3 below.
Southeast Rocky Mt. slope	46 .5	46 .2	Normal.
Missouri valley	24 .1	21 .3	2°.8 below.
Upper Miss. valley & Minn.	20 .0	17 .6	2°.4 below.
Upper Lake region	19 .3	17 .2	2°.1 below.
Lower Lake region	24 .0	21 .6	2°.4 below.
Ohio valley and Tennessee	37 .5	35 .6	1°.9 below.
Rio Grande valley	60 .0	58 .4	1°.6 below.
Western Gulf States	53 .1	50 .0	3°.1 below.
Eastern Gulf States	51 .4	48 .8	2°.6 below.
Florida	62 .3	59 .9	2°.4 below.
South Atlantic States	47 .8	45 .4	2°.4 below.
Middle Atlantic States	33 .9	31 .5	2°.4 below.
New England	25 .9	21 .3	4°.6 below.
St. Lawrence valley	17 .7	11 .3	6°.4 below.
Canadian Maritime stations	18 .0	19 .5	1°.5 above.
Mt. Washington, N. H.	6 .4	−0 .7	7°.1 below.
Pike's Peak, Col	3 .1	7 .4	4°.3 above.



TEMPERATURES OF WATER FOR FEBRUARY, 1879.

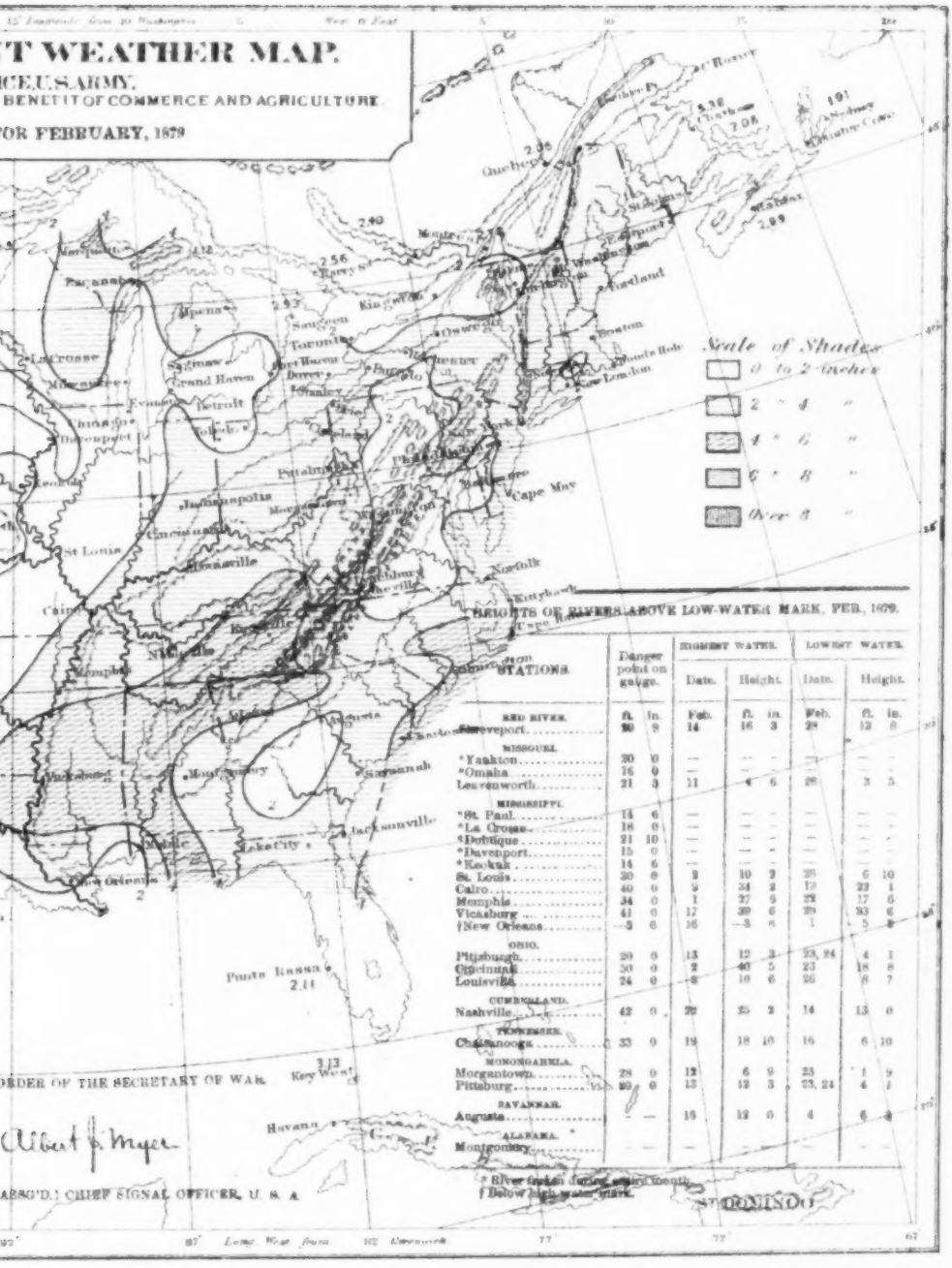
STATIONS.	Temperatures at bottom.		Average depth of water.
	Maximum.	Minimum.	Feet.
*Alpena	—	—	—
Augusta	55	43	8½
Baltimore	35	30	11
*Buffalo	—	—	—
*Burlington, Vt.	—	—	—
Charleston	56	44	43
†Chicago	34	29	—
*Cleveland	—	—	—
†Detroit	33	33	20
†Duluth	32.5	32.5	10½
Eastport	35.5	32.5	16
*Escanaba	—	—	—
Galveston	60	55	13
*Grand Haven	—	—	—
Jacksonville	61	55	18
Key West	76	65.4	16
†Marquette	33	32.5	15½
†Milwaukee	32	31.5	12½
Mobile	54	50	15
New London	34	32	11½
†New York	34	32	14½
Norfolk	48	38	16
Portland, Maine	32	31	20
Punta Rassa	71	61	13
San Francisco	—	—	—
*Sandusky	—	—	—
St. Marks	60	60	18
Savannah	55	50	8
*Toledo	—	—	—
Wilmington	51	44	13½
Wood's Hole	32	30	8

* Observations interrupted by ice.
† Observations for only part of [illegible]



AVERAGE PRECIPITATION FOR FEBRUARY.

DISTRICTS.	Average for February.		Comparison of February, 1874, with the average for many years.
	For many years.	For 1874.	
	Inches.	Inches.	
St. Lawrence valley	3.03	2.18	0.85 deficiency.
New England	3.10	2.00	0.10 deficiency.
Middle Atlantic States	3.65	2.35	1.30 deficiency.
South Atlantic States	3.35	2.80	0.19 deficiency.
Eastern Gulf States	4.25	3.00	1.25 deficiency.
Western Gulf States	2.90	2.50	1.40 deficiency.
Tennessee	4.90	4.60	1.30 deficiency.
Ohio Valley	3.35	2.15	1.20 deficiency.
Lower Lake region	2.60	2.50	1.10 deficiency.
Upper Lake region	1.75	2.20	0.45 excess.
Upper Mississippi Valley	1.50	1.15	0.40 deficiency.
Minnesota	0.70	1.00	0.30 excess.
Lower Missouri Valley	1.55	1.00	0.55 deficiency.
Upper Missouri Valley	0.78	0.59	0.19 deficiency.
California Coast	2.55	2.97	0.42 excess.
Portland, Or	7.60	13.32	5.62 excess.


T WEATHER MAP.
ICE U.S. ARMY.
BENEFIT OF COMMERCE AND AGRICULTURE.
FOR FEBRUARY, 1879
Scale of Shades.
0 to 2 inches
2 " 4 "
4 " 6 "
6 " 8 "
Over 8 "
HEIGHTS OF RIVERS ABOVE LOW-WATER MARK, FEB., 1879.
STATIONS.
Danger point on gauge.
HIGHEST WATER.
Date.
Height.
LOWEST WATER.
Date.
Height.
RED RIVER.
Shreveport
MISSOURI.
*Yankton
*Omaha
Leavenworth
MISSISSIPPI.
*St. Paul
*La Crosse
*Dubuque
*Davenport
*Keokuk
St. Louis
Cairo
Memphis
Vicksburg
†New Orleans
OHIO.
Pittsburgh
Cincinnati
Louisville
CUMBERLAND.
Nashville
TENNESSEE.
Chattanooga
MONONGAHELA.
Morgantown
Pittsburg
SAVANNAH.
Augusta
ALABAMA.
Montgomery
* River frozen during entire month.
† Below high-water mark.
ORDER OF THE SECRETARY OF WAR.
Albert J. Myer
BRIG'D. CHIEF SIGNAL OFFICER, U. S. A.

WINDS, IN MILES PER HOUR, ACCOMPANYING THE STORMS.

American Coast.

No. I. [illegible]

II. [illegible]

IV. [illegible]

VII. [illegible]

VIII. [illegible]

European Coast.

[illegible]

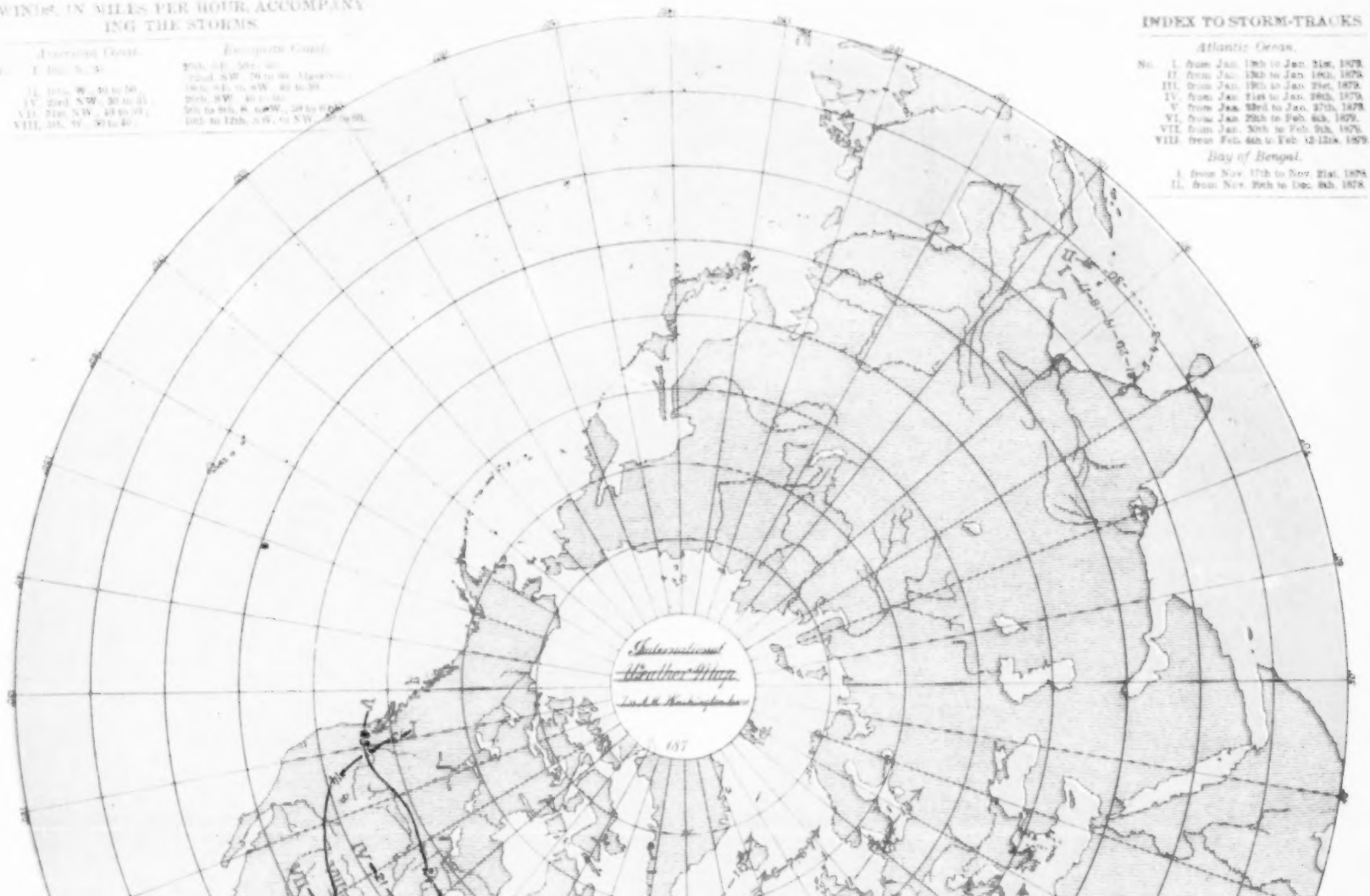
INDEX TO STORM-TRACKS

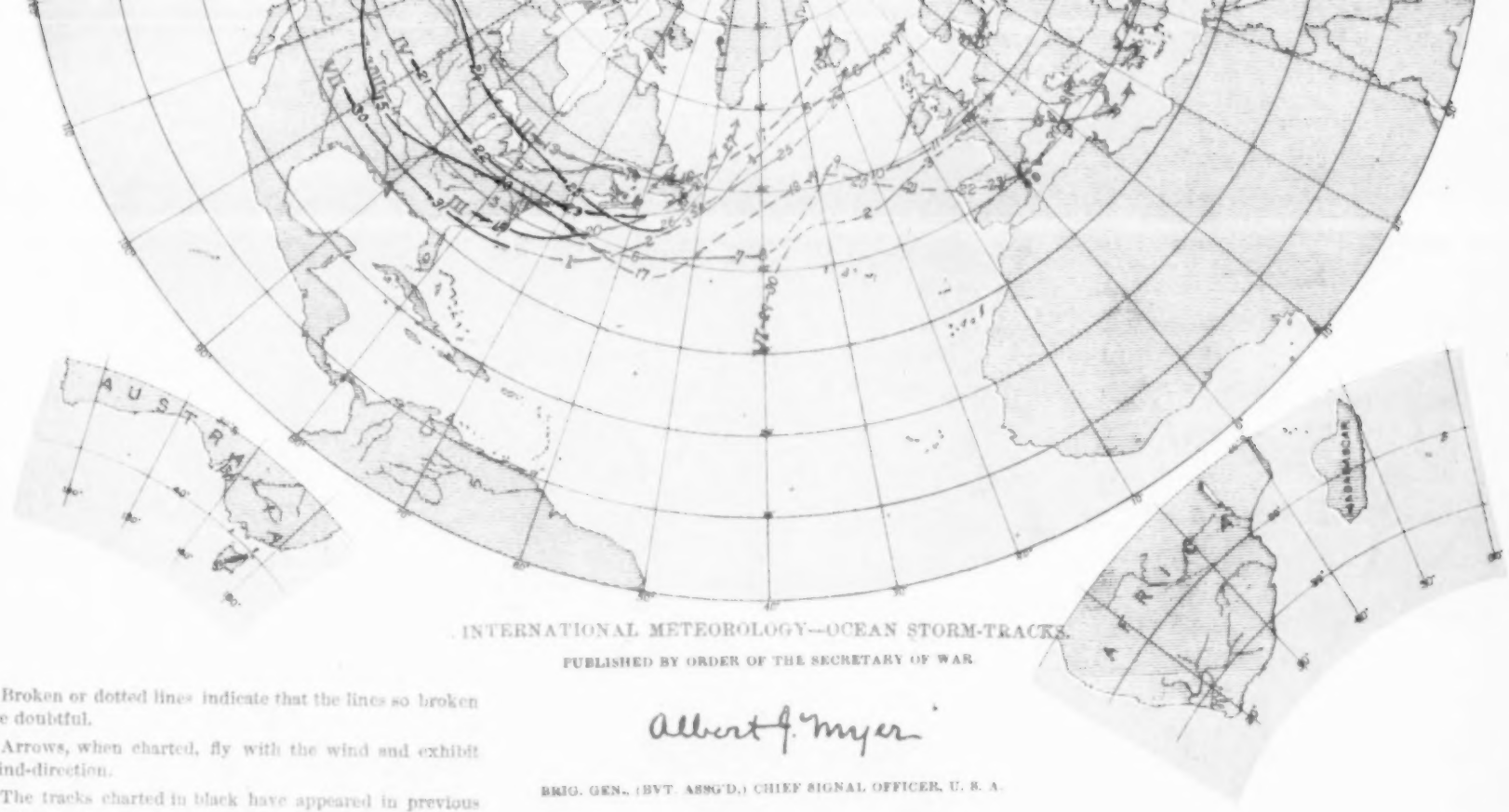
Atlantic Ocean.

No. I. from Jan. 19th to Jan. 31st, 1879.
II. from Jan. 13th to Jan. 19th, 1879.
III. from Jan. 19th to Jan. 31st, 1879.
IV. from Jan. 31st to Jan. 9th, 1879.
V. from Jan. 23rd to Jan. 27th, 1879.
VI. from Jan. 29th to Feb. 6th, 1879.
VII. from Jan. 30th to Feb. 9th, 1879.
VIII. from Feb. 6th to Feb. 12-13th, 1879.

Bay of Bengal.

I. from Nov. 17th to Nov. 21st, 1878.
II. from Nov. 29th to Dec. 8th, 1878.





INTERNATIONAL METEOROLOGY—OCEAN STORM-TRACKS.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Albert J. Myer

BRIG. GEN., (BVT. ASS'G'D.) CHIEF SIGNAL OFFICER, U. S. A.

Broken or dotted lines indicate that the lines so broken are doubtful.

Arrows, when charted, fly with the wind and exhibit wind-direction.

The tracks charted in black have appeared in previous *Reviews*.

The tracks charted in red have been made from data collected since preceding *Review*.

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